PLASTICS TECHNOLOGY

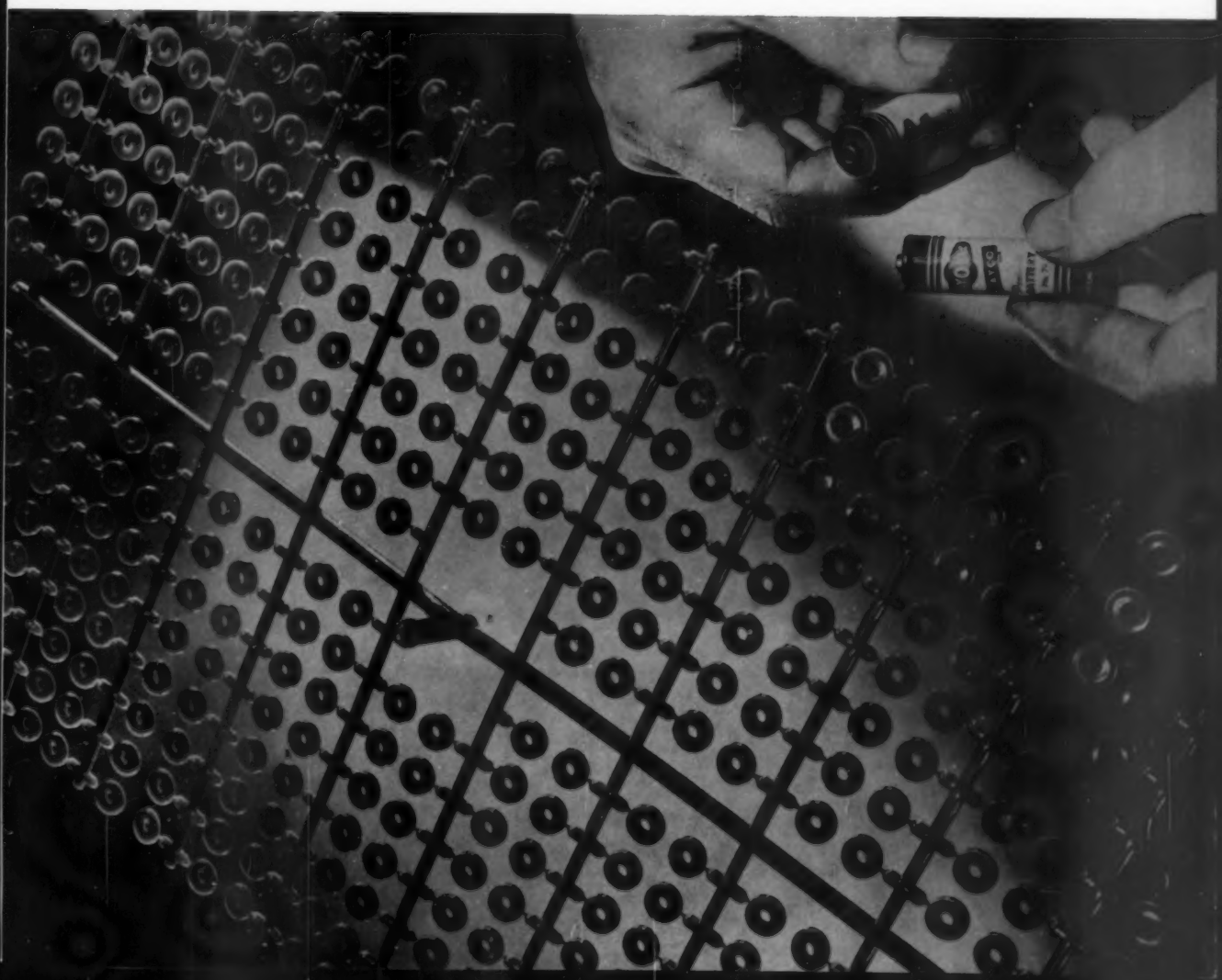
April 1959

THE MAGAZINE OF APPLIED ENGINEERING

H-D Vinyl Foams ..... page 32

Blow Molding Potentials ..... page 53

Dry Coloring Technique ..... page 27



Canadian General Electric Co., Ltd.

New streamlined transformers, molded in Epon resins, have superior insulation and dielectric strength. Accuracy and over-all performance are greatly improved.

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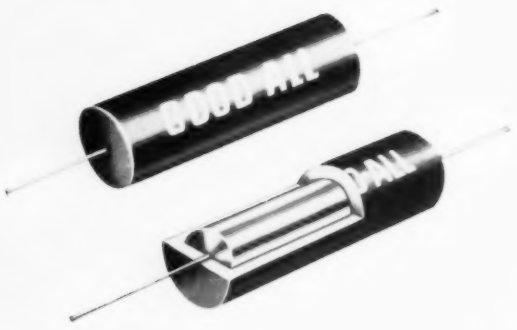

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The new luxury Dualette TV set by Sylvania* is designed to serve a double purpose . . . as a lightweight dual-speaker portable . . . and as a chic table model, handsome on all sides, even the back. Therefore the plastic for the cabinet, molded in two sections, had to meet twin requirements . . . feather-light toughness for portability . . . lustrous beauty of hue and of surface, in three charming color combinations to blend with room decor when seen from any direction. Sylvania's choice of molding compound for the cabinet was an obvious one . . . heat resistant, high impact CATALIN STYRENE.

The desirability of CATALIN STYRENE—*the gem of plastics*—is dual in another sense, too, for its value to molders and manufacturers is twofold: first, Catalin offers the widest range of formulations, with the very highest standards of quality . . . and, secondly, Catalin — through its strategically located facilities in the East, Midwest and South, linked in a sales-office-to-warehouse teletype network — routes orders to molders with on-the-dot scheduling. This double assurance of basic-material satisfaction is yours when you specify Catalin Styrene, Polyethylene and Nylon molding compounds. Inquiries invited.

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PLASTICS

THE MAGAZINE OF APPLIED ENGINEERING

TECHNOLOGY

APRIL 1959 VOLUME V NUMBER 4

FEATURE ARTICLES:

A NEW LOOK AT DRY-COLOR DISPERSION p.27

By A. R. Morse

Problems involved in color-dispersion nozzles for injection molding are discussed in detail. Proper dry coloring is a complex problem that can depend on nozzles, nozzle-mixing devices, heating cylinders, material-handling techniques, and brand of material and colorant.

HIGH-DENSITY CELLULAR VINYL BY DIRECT EXTRUSION p.32

By R. J. Meyer and Donald Esarove

With a direct-extrusion method using conventional equipment, gas can be incorporated into vinyl. In this method, gas can be considered a filler that imparts unique properties and economic advantages, making it a more desirable loading agent than solid fillers for many applications.

BRUSHABLE RESURFACER FOR FIBERGLASS PANELS p.39

By K. J. Berg and M. C. Slone

Results of a test program are given to show the effects of a brushable, refinishing coating. These include superior weathering properties; superior water and temperature resistances; and good light and heat transmission qualities.

PHYSICAL PROPERTIES OF PREMIX MOLDINGS p.43

By H. R. Sheppard and R. H. Calderwood

A study of glass-polyester premix materials molded by compression and transfer methods shows that impact strength, flexural strength, and fiber orientation of the resulting parts are affected by sprue diameter size and the method of molding.

GUEST EDITORIAL:

POTENTIALS FOR DIVERSIFICATION OF THE POST-THERMOFORMING INDUSTRY p.38

By Gerhard Kostrzewa

ENGINEERING FORUMS:

MACHINERY MAINTENANCE p.52

By George E. Ventz

Repairs of Damaged Molds and Mold Alterations

BLOW MOLDING p.53

By E. Bowman Stratton

The Enlarging Blow Molding Field

EXPLORING FABRICATION TECHNIQUES

WIRE AND CABLE COVERING. POLYURETHANE FOAMS p.48

By L. J. Zukor

FEATURE DEPARTMENTS

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Cover: Ray-O-Vac battery washers are injection molded 300 at a time by Evans Color Plastic Co. Material is Eastman Chemical's Tenite polyethylene.

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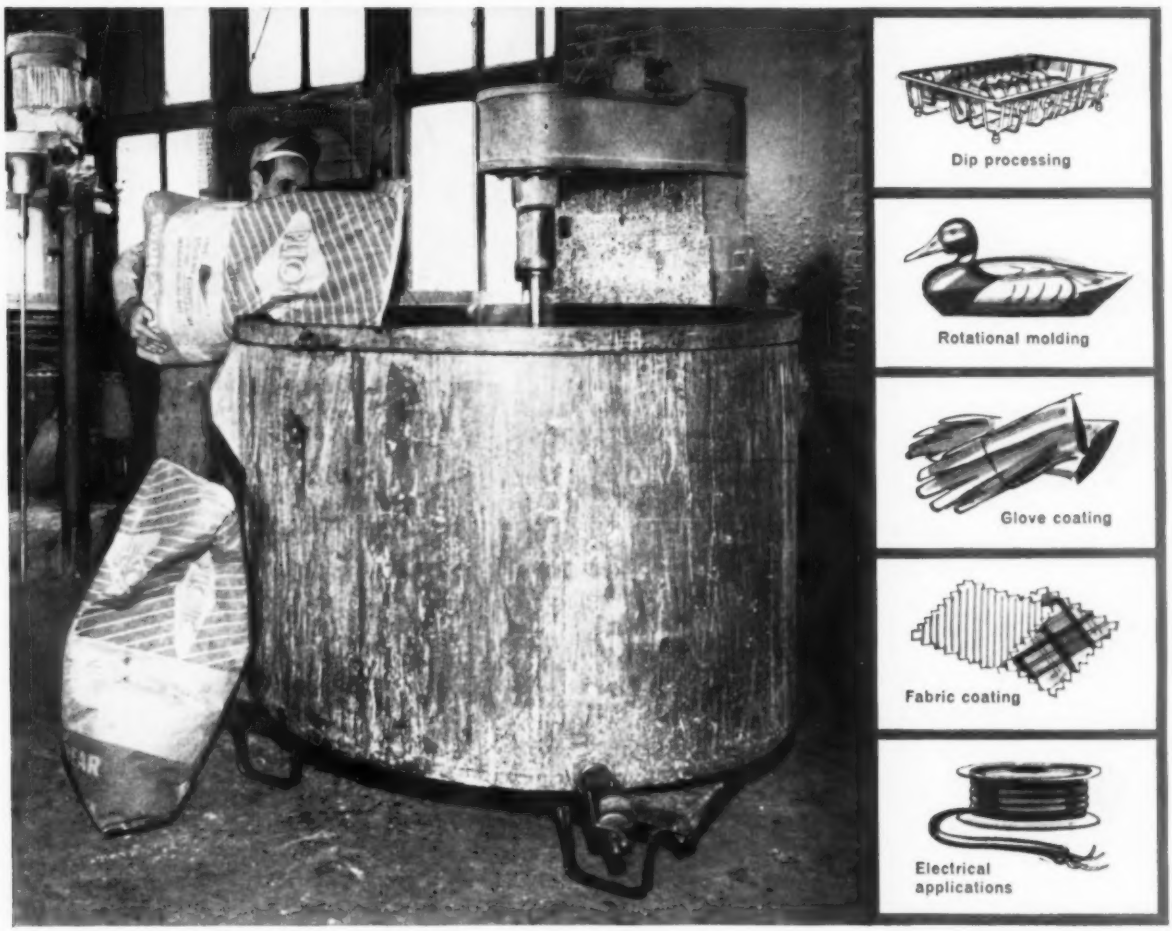

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Other big potentials for PLIOVIC VO: In glove and fabric coating compounds where superior adhesion and excellent physical properties are required. Moreover, PLIOVIC VO can be made into compounds with electrical properties equal to electrical grade extrusion resins.

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Previews of Next Month

The May issue will feature the following articles and special material:

Embrittlement of Polyethylenes. C. S. Imig, Sr. Staff Member, Sales Service Lab., Spencer Chemical Co., Kansas City, Mo.

Exposure at elevated temperatures below the crystalline melting point of the plastic results in heat embrittlement because of polymer crystallinity and polymer degradation by oxidation. No definite correlation was found between heat embrittlement and polymer density, but a definite relationship was found to exist between heat embrittlement and polymer melt index.

•

Molding of Diallyl Phthalate Compounds. L. B. Keller, W. R. McGlone and D. H. Woodin, Members of Tech. Staff, Hughes Aircraft Co., Culver City, Calif.

The effects of completeness of cure, dimensional stability, resin flow, fiber length and particle-size of fillers, molding shrinkage, and other factors on molding characteristics of the material are described and discussed in detail. DAP compounds available and typical molding defects are mentioned.

•

Engineering Thermoplastics for Ocean Telephone Cable. J. B. Howard, Supervisor of Wire & Cable Thermoplastics Group, Bell Telephone Labs., Inc., Murray Hill, New Jersey.

Important engineering factors for marine telephone cables are reviewed, with particular emphasis on thermoplastic materials. Factors discussed include cable construction, electrical requirements, material contaminants, and the need for stress-cracking resistance in both current and future types of plastic materials.

•

SPECIAL SECTION

What a Plastics Engineer Should Look For When Planning to Buy Auxiliary Equipment for Injection Molding. Gordon B. Thayer, Plastics Specialist, Plastics Tech. Service, Dow Chemical Co., Midland, Mich.

PT's Comparative Data Tabulation on 1959 Injection Molding Machines, with Classified List of Auxiliary Equipment.

•

The guest editorial will be: **"Technical Services—Responsibilities of Resin Supplier,"** by R. Vernon Jones, Mgr. of Tech. Services & Devel., Plastic Sales Div., Phillips Chemical Co., Bartleville, Okla.

Letters to the Editor

Thanks from ISO/TC 61

Dear Sir:

On behalf of the American Group for ISO TC 61, I would like to thank you for printing the complete report on the Eight Annual Meeting of the International Plastics Committee in Washington last November (*Feb. 1959 issue, p. 79*). I know that I speak for Mr. Brown, who has succeeded me as chairman of the American Group, and for the ASA which holds the secretariat, when I say that we were most appreciative of the fine response.

PLASTICS TECHNOLOGY continues to make excellent progress. Your publication has increased in stature with each succeeding issue.

C. H. Adams, Mgr. of Plastics Prod. Devel., Monsanto Chemical Co., St. Louis, Mo.

• • •

Correcting an Error

Dear Sir:

In the January issue, there was an article in the section, Plastics Applications. This was an article and picture on a Semi-Automatic Projector.

The article was good and we appreciate you running it in the magazine. There was just one thing that I did not like, and that was the reference to our company. It said that Auburn Plastics, Inc., was using a Standard Tool and Die Company designed mold.

We have had occasion of late to be very careful about the title of our company which is only Standard Tool Company. In one of the Western states, we were challenged by the Secretary of the state that we were infringing on the name of a company incorporated in that state. So you see, it is very important that our name be correct in any such article or advertisement.

L. B. Kavanagh, Pres. Standard Tool Company Leominster, Mass.

(We are happy to print this letter to atone for the error. In our defense, we can say that the original press release that was the basis for our write-up had the wrong company title. Of course, we should have corrected it before publication, but we did not. Our abject apologies for the error.—Editor)

New Terminology Proposed

Dear Sir:

I notice that Mr. Zukor refers to his section in your magazine as "Exploring Fabrication Techniques."

Normally, we consider fabrication techniques to involve operations such as sawing, nailing, screwing, gluing, etc., which do not involve a change in the physical state of the plastic. Mr. Zukor's interests seem to lie more in the area of what I like to call "polymer processing."

The reason for my letter is to solicit your views on this terminology, and to suggest that "Exploring Processing Techniques" might perhaps be a more accurate title for Mr. Zukor's section.

(Identity Withheld)

(We believe that these comments are well taken and worthy of serious consideration. Actually, we have been thinking of a new title for Lee Zukor's section, and would be interested in receiving more suggestions and comments from our readership.—Editor)

Information Wanted

Dear Sir:

I intend to start manufacturing male mannequins in the near future. If possible, could you pass along any information concerning a firm that manufactures a spray gun that would apply plastic or fiber glass to a mold.

Any ideas or suggestions that you might offer will be appreciated.

P. T. Chemodurow Theodore's Men's Wear Wallace, Idaho

(Any replies from our readers can be sent either directly to the inquirer or to this office, for transmittal.—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

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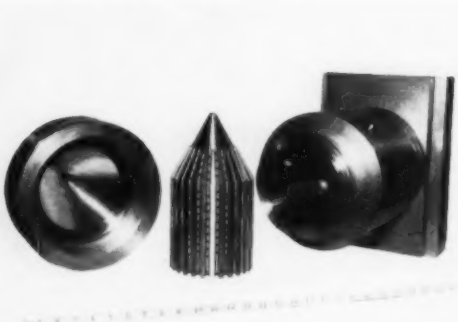
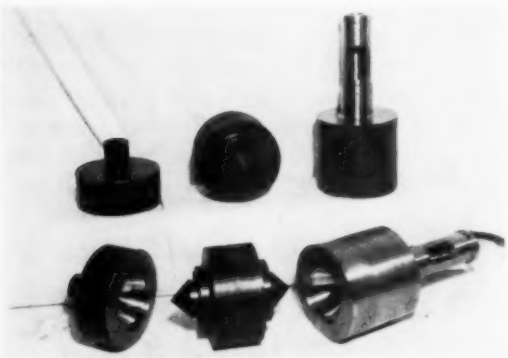
Jobs sometimes start using a sample heater. Here we look over a worn out #10 Reed-Prentice, to be replaced by an IMS one piece leakproof oversize cylinder. Doubles press output.

IMS integral (solid) heated spreaders pour heat into the plastic from both sides. Here small 5 inch spreaders for 2-3 oz. Van Dorn, Moslo and Fellows are contrasted with a 14 inch unit for a 60 oz. Watson-Stillman.

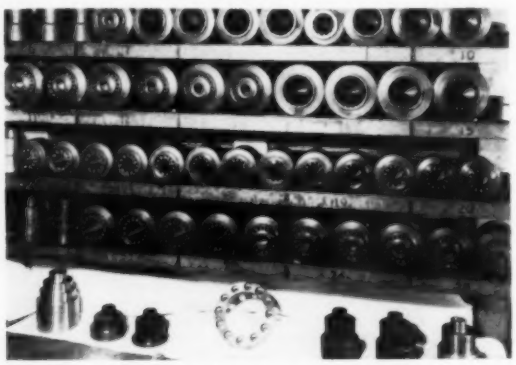
It takes lots of handwork to make a good heater. Here spreaders for new and repaired cylinders are being polished. Spreader at left has seen five years service.



Yes-we make experimental cylinders too. Here is a huge polyliner type unit made to order. Tests prove it has less than half the capacity of a standard IMS Replacement Cylinder for the same machine.



Stock cylinders for 2-1/2 oz. Van Dorn quadruple plasticizing capacity. We make high output heaters for Stokes, Reed, Fellows, Impco, in fact for every type of injection machine.



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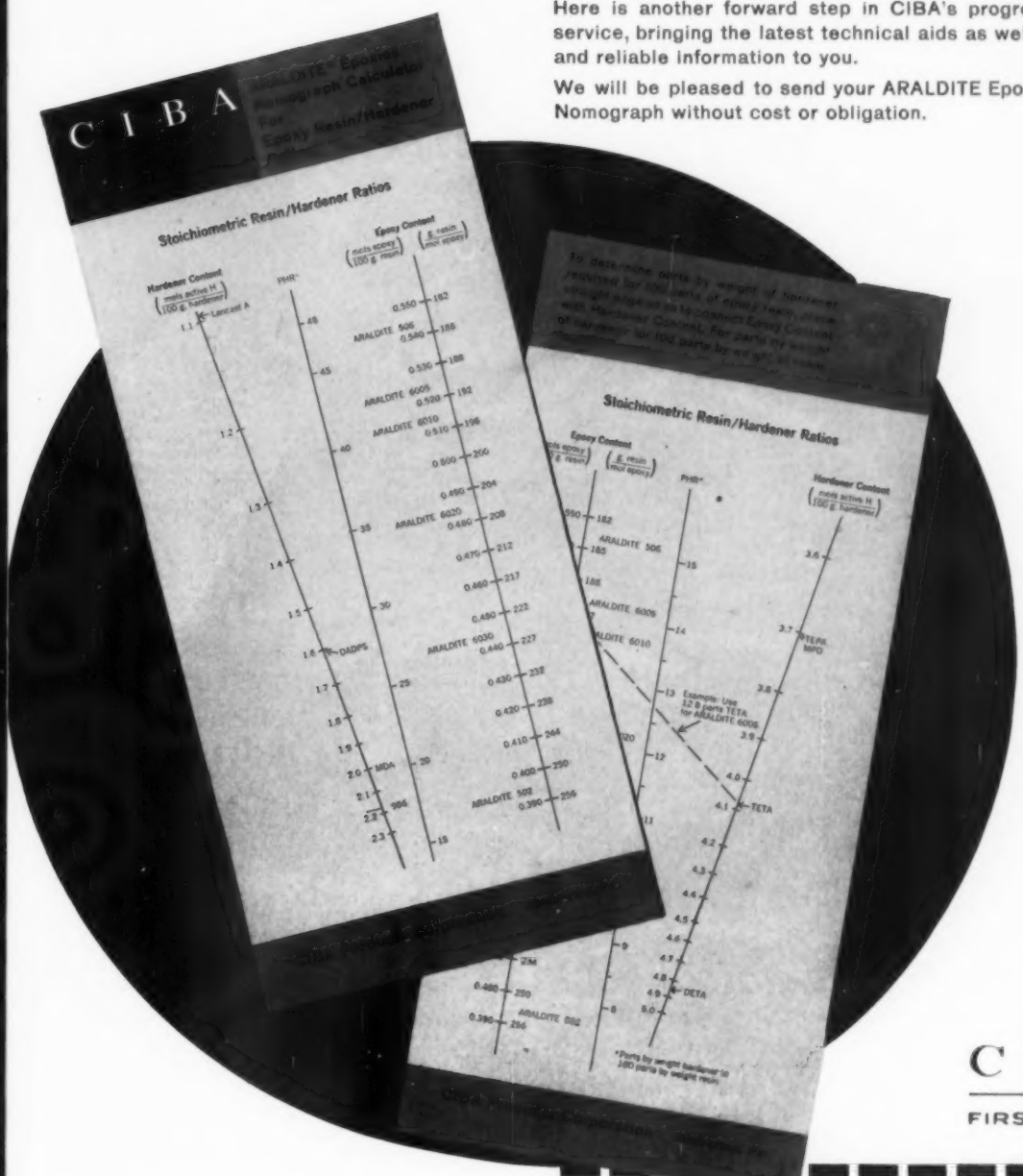

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PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

APRIL, 1959

EDITORIAL: Guest Editorials Invited

A standard feature of PLASTICS TECHNOLOGY since its inception has been the monthly Guest Editorial contributed by company spokesmen or other individuals in the domestic plastics industry.

Some of our Guest Editorials to date have been unsolicited and, in fact, even unexpected. Others, on the other hand, resulted from our invitations to the authors that they expand or enlarge on comments they had previously made in letters or phone conversations.

In line with the editorial changes and improvements being made in the magazine this year, we would like to discuss the Guest Editorials in greater detail.

•

We look upon Guest Editorials as providing a sounding board whereby any responsible person in the plastics industry, speaking either for himself or on behalf of his company, can express any thoughts or opinions meriting attention by our readership.

Interest to the readers is the only requirement. Guest Editorials can be on any subject, technical or non-technical, but it should be noted that our readers are essentially technical in nature by virture of education and or training. Accordingly, the Guest Editorial subject should have special meaning or significance to these readers.

An important point to be emphasized is that Guest Editorials are not subject to any censorship, either expressed or implied, on our part. They are edited only for grammar, punctuation, sentence structure, etc., designed to help the author present his views as clearly and forcefully as possible. This, whether or not we agree with his views!

If in the course of editing we come across a statement that could prove detrimental to the author, his company, or to some other person or firm, we will so inform the author and suggest a remedial change. This change, is only a suggestion, however, and will not be made unless first approved by the author.

In essence, all editing is intended to best serve the author's interest.

Finally, the Guest Editorial can range from 750 to 1,500 words in length. When published, it is accompanied by the author's name, title, company affiliation, and photograph.

•

We invite our readers to submit Guest Editorials for publication in the magazine. The only requirement is that we be advised in advance as to the subject and expected availability date of your manuscript. This information will help us resolve any conflicts in subjects, and also permit early publication of your Guest Editorial when it is received here in our offices.

Now, after this invitation, can we expect to hear from you?

Arthur M. Merrill
Editor

DOW | VINYLTOLUENE

Resin blend and dry fibers are mixed by a kneading screw which carries the mix to a sizing extruder. Extruded loaf is cut to length, ready for molding, by means of a photo electric cell unit.

Very low press cycle produces finished housing. Housings are now automatically placed on conveyor belt and sent to flash trimming and assembly stations.

Premix moldings speed assembly, make a better heater housing for Ford Motor Company

When you turn to premix moldings for reinforced plastic parts, you benefit from higher quality of product and increased production. The Ford heater housing above is a prime example.

The housings formerly were made of stamped and welded metal. A switch to premix molding eliminated time-consuming assembly problems, produced a better product and increased production rate. Fillets, slots, holes and recesses are formed in the mold, clean-cut and precisely located. Final assembly is quick and easy. Unit costs are lower.

For making reinforced plastic products, premix molding has many advantages. Because the reinforcing fibers are blended with the resin *before* molding, they are uniformly distributed, regardless of wall shape or thickness. This means uniform strength throughout the unit. Preforming is eliminated. So are resin-rich areas, no matter how complex the mold or how heavy the section.

Molders of strong, rigid, reinforced plastic parts have found that premix moldings made with Dow vinyltoluene and Dow styrene have definite manufacturing and product advantages. Production is higher, costs are lower. Premix molding may benefit *your* operation, too. For more information, write today to THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. 2378DT4.

THE DOW CHEMICAL COMPANY · MIDLAND, MICHIGAN

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

APRIL, 1959 — U.S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

Packaging Show — The 28th Annual AMA National Packaging Exposition will be held this year at the International Amphitheatre in Chicago, April 13-17. Close to 400 companies will have exhibits at the show. More than 35,000 visitors are expected from every state in the union, Canada and several dozen foreign countries. Exhibits will cover the entire range of the packaging industry — machinery, materials, methods, services, design and finished packages.

Running concurrently with the Exposition will be the AMA National Packaging Conference at the Palmer House, April 13-15. Conferees will hear discussion of such subjects as top management appraisal of packaging, utility in package design and special problems in industrial packaging.

Last Packaging Exposition to be held at the International Amphitheatre, Chicago, was in 1957. Show drew visitors from all over the world.

U.S.I. exhibit at the Packaging Exposition will feature a staff of technical experts to answer questions about poly film and packaging problems. As a supplier of polyethylene resins, U.S.I. frequently has been able to make suggestions that have saved packagers the necessity of making costly changes in their operations. Packagers are encouraged to make use of this opportunity to discuss innovations in poly film packaging that have been developed in the past year. Also available at the exhibit will be new application and technical data on cast film. The U.S.I. exhibit will be at Booth No. 1133-1135.

New dual dispensing squeeze bottle is a good example of polyethylene's versatility. Poly bottle dispenses medication via calibrated dropper at one end; nozzle and valve at other end permit use as a squeeze spray. A removable base cap at the nozzle end enables the bottle to be stood on end in the medicine cabinet.

Farm produce is fresher when packaged in polyethylene liners, government researchers report. Cabbages stored in poly-lined crates were found to have lost less than one percent of their weight after a week's storage. Drying out of cabbages stored in unlined crates over the same period resulted in a weight loss of 14 per cent.

Cast Polyethylene Film Makes Big Gains As Ultra-Clear Packaging Material

First Introduced by U.S.I. at Last Year's Packaging Show

A year after it was first introduced to the industry by U.S.I., ultra-clear cast polyethylene film has firmly established itself as a leading transparent packaging material. Cast film is now being widely used to package produce, frozen foods, hosiery, even tortillas and tamales. As an overwrap, cast film is packaging bread, paper plates and towels, napkins, sheets and pillowcases. Production of cast film, now about a million pounds a month, is expected to triple by 1960. At time of introduction, cast film was produced only on laboratory scale. Now approximately six film extruders are making cast film, and another six or eight have plans to produce the film within the year.

Cast film has shown that it can compete successfully with the most popular conventional transparent films in clarity and gloss. And its price is lower than most.

In just a year since its introduction by U.S.I., cast polyethylene film has firmly established itself as a leading transparent packaging material. It is now used to package hundreds of different consumer products.

Uses Extrusion Coating Equipment

Cast film, first announced by U.S.I. at the Packaging Show in April, 1958, is made by a different processing technique than normally used in polyethylene film production. In the process, polyethylene is extruded and drawn or cast across a highly polished chrome-plated roll. This casting step greatly improves the optical characteristics of the film. An immediate and even quenching prevents the formation of haze-producing crystals in the matrix of the polyethylene, and the polished roll surface produces a glossy surface on the film.

In making cast film, choice of resin is important. U.S.I.'s and customers' experience has, in general, shown PETROTHENE 205 — with a density of 0.924, melt index of 3.0 — to have optimum properties for making bags, and PETROTHENE 239 — with a density of 0.929, melt index of 5.0 — to be best for making overwrap film. Where special property combinations are desired, U.S.I. has a variety of other resins that can be used.

Although the equipment needed for making cast film is initially more expensive, production costs are competitive with those for conventional extruded film. Production speed is the same or greater.

Polyethylene Quality Control – I

Melt Index Test Assures Uniform Molding Properties

Melt index is used widely to indicate flow rate of a polyethylene resin. Uniformity of melt index helps assure uniformity of such other resin properties as production rate, low temperature flexibility and resistance to stress cracking.

At U.S.I., melt index of every lot of PETROTHENE resin is determined in accordance with ASTM method D1238-57T. The test in effect measures the amount of heated resin that is extruded through a standard orifice at a given pressure. The melt index of the resin sample is the weight in grams extruded in ten minutes. To insure uniformity within the same lot and from lot to lot, U.S.I. routinely measures the melt index of separate samples taken from various points within each lot.

Processors interested in details of the ASTM melt index test may obtain free copies of ASTM D1238-57T by writing the Editor, U.S.I. POLYETHYLENE NEWS.

Tables Simplify Calculation of Film Thickness, Weight

A new 8-page booklet prepared by U.S.I. enables processors to make quick, accurate calculations concerning gauge and weight of polyethylene film and bags.

The booklet contains simplified tables and formulas for solving such problems as average thickness of film or bag that can be expected when density, weight and dimensions are known; number of feet per pound of film that will be yielded by a roll of known thickness and width; number of bags of a given size and gauge that can be made from a pound of resin.

Copies of the booklet, titled "Formulas and Tables for Polyethylene Film and Bags," may be obtained by writing Editor, U.S.I. POLYETHYLENE NEWS, 99 Park Avenue, New York 16, N. Y.

DO YOU HAVE a new polyethylene packaging development you'd like the industry to know about? Make it routine to send your information on new developments to U.S.I. POLYETHYLENE NEWS.

Address the Editor,
U.S.I. POLYETHYLENE NEWS, U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., 99 Park Avenue, New York 16, N. Y.

2-mil cast polyethylene film made from PETROTHENE 239-27 resin has unprecedented clarity and gloss.

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new...
clear
inexpensive

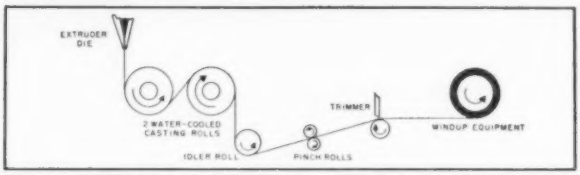
CAST POLY FILM PACKAGES IT BETTER...FOR LESS!

In a single year cast polyethylene film has become a major packaging material. Frozen food, produce, bread, hosiery, sheets, towels, paper plates . . . even tortillas and tamales are now packaged in clear, tough cast poly film. Here's why you offer your customers a better packaging material for their money when you offer them cast polyethylene film:

CRYSTAL CLARITY – PETROTHENE® cast poly film has an appearance equal to or better than that of other commonly used transparent packaging films. What's more it has a soft, natural flexibility that adds a look of quality to packaged goods.

SUPERIOR PACKAGING PROPERTIES – PETROTHENE cast film has good impact and tear strength, high grease resistance and is an excellent moisture barrier. It heat seals well and is easily printed. Cast film handles well in overwrap machinery designed for conventional polyethylene film.

ECONOMY – Your customers will pay less for cast poly film than for other highly transparent flexible packaging materials—whether they figure costs per pound or per unit area of film. It is the most inexpensive high-clarity overwrap material your customers can buy.



Cast polyethylene film is made by a special process employing U.S.I. PETROTHENE resins. U.S.I. will be glad to furnish technical assistance to extruders interested in manufacturing cast poly film. Contact your nearest U.S.I. office, or write:

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

NEWS in BRIEF

Outlook for 1959 and 1960 favors quality which, in turn, should lead to new applications for thermoformed plastic products, says Gerhard Kostrzewa, consultant (see Guest Editorial, page 38). Guesswork in a research program can prove costly. What is needed is a proper balance between quantitative and qualitative aspects of such a program, with more time and effort spent on new ideas and broadening of technological skills.

Company expansions in plastics continued in the news this month. Air Reduction Chemical officially opened its new lab and engineering building in Bound Brook, N. J. Allied Chemical completed new phthalate ester plasticizer facilities at its Toledo, O., plant. General Tire & Rubber has enlarged its plastics design facilities. Haveg Industries installed a giant press for making plastic parts. Kaye-Tex Mfg. completed its $1.5-million expansion program for making vinyl film and sheeting. Metalmold Forming moved to new and larger quarters in Brooklyn, N. Y. Perlon installed new equipment for increasing its production of polyurethane resins. Pla-Tank division of Haveg built a new plant in Warren, Mass., for the manufacture of large r-p chemical process equipment. Reichhold initiated production of PVA and acrylic emulsions at its Jacksonville, Fla., plant. Taylor Fibre undertook a new capital improvements program. U. S. Industrial Chemicals opened its new polyethylene plant in Houston, Tex. Dow opened its polystyrene film plant.

Business developments in the plastics industry show typical activity for this rapidly-growing field. American Cyanamid set up separate administrations for its organic chemicals plants in Marietta, O., and Willow Island, W. Va. Bestwall Certain-Teed changes the address of its Twin Cities office in Minneapolis, Minn. Bel-Art Products acquired all assets of E. J. Kanter Co. Camdale bought a controlling interest in Commercial Fiberglas Products, Houston, Tex., and transferred its home offices to that city. Cheminform Institute has broadened its facilities. Colton Chemical opened a new sales office and warehouse in Tampa, Fla. Continental-Diamond Fibre appointed Summers Electric Co. as stocking distributors for its line of vulcanized fiber and laminated plastics. Engineered Materials is the name of a new rubber and plastics firm in New York, N. Y. Gering Products is offering new flame-retardant grades of plastics materials. Hastings Plastics was appointed exclusive West Coast distributor for metal fiber fillers used in plastics. Koppers appointed Central Oil Paper Co. as distributor for its polyethylene film. Libbert Plastics is a new custom-molding firm in Ft. Worth, Tex. Polycraft Bag Co. is a new polyethylene bag firm in South Bend, Ind. Rexall Drug will change its name to Rexall Drug & Chemical Co. because of the sales gains shown by its Chemo-Plastics division. Reichhold bought Specialty Chemicals, of Austin, Tex., and will operate it as a wholly-owned division. Riverside Plastics purchased Bischoff Chemical Corp., and will manufacture and market the latter's line of strippable coatings.

New Materials worthy of attention (see pages 65-7): three rigid vinyl sheetings; four grades of skived Teflon tapes; styrene-methyl methacrylate molding material; heat-resistant, styrene-modified, rigid polyester material for high-temperature strength retention; epoxy resin-impregnated glass fiber insulating material; low molecular-weight polyethylene wax; and yellow strontium chromate pigment.

New Equipment of special interest (see pages 68-73): two-color marking head for hot stamping press; wall-mounted tensile testing machine; vacuum chamber dryer; high-speed plastics welder with automatic feed; oven for preheating and drying; heavy-duty embossing roll stand for independent or integrated usage; and h-f dielectric heating unit for preforms.

Plastics Applications to be noted (see pages 74-7): boat hull of glass fiber-reinforced epoxy; three-position polyethylene sink for washing corrosive acids from transistor elements; veneer of paper with epoxy coating; saran fiber rope; molded polypropylene ball valves; nylon cap nuts; bondable skived Teflon tape; and polyethylene cones for auto lane markers.

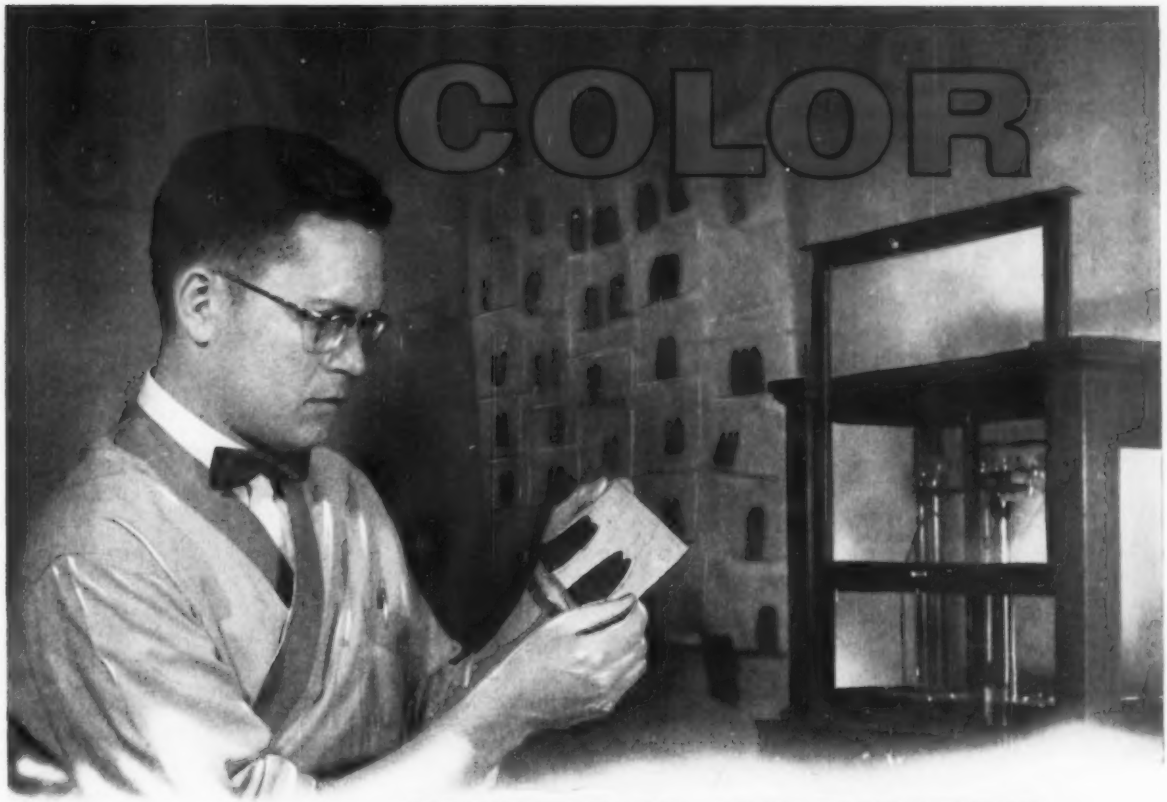
The toughest films start with *"TOUGH 706"*

The drop-dart test demonstrates the toughness of industrial films. The film that survives the highest drop of a weighted dart without tearing is, naturally, the one with the greatest impact strength. None "can take it" better than film extruded from Monsanto Polyethylene 706.

That's not surprising. 706 was specifically developed to produce the high grade of toughness called for in industrial packaging and barrier requirements. In addition, this resin is extremely uniform, blend to blend and bag to bag, to assure great consistency in extrusion and converting. Ease of opening and dependable heat sealing are other reasons why 706 today is already performing successfully in hundreds of industrial film applications.

For complete resin and processing data and a report on the drop-dart test write to Monsanto Chemical Company, Plastics Division, Room 1302, Springfield 2, Mass.

Monsanto



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STAN-TONE
● PASTE - *in Plasticizer*

STAN-TONE
● PEC - *in Polyester Vehicle*

STAN-TONE
● GPE - *Ground Polyethylene*

STAN-TONE
● MBS - *in Plasticized Resin Latex*

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Relative Ratings of Low-Temperature Vinyl Plasticizers

(10 = best, 0 = poorest)

	Dioctyl Isosebacates	Diisooctyl Isosebacate	Octyl Sebacates	Octyl Azelates	Octyl Adipates	Diisodecyl Adipate	Dioctyl Phthalate (blending material)
Compatibility (roll spew)	6	5	6	7	9	5	10
Strength: tensile, modulus, elongation	7	6	7.5	7.5	8	7.5	9
Low Temp.: stiffness, brittle point	7.5	7.5	8.5	8.5	8.5	7.5	3.5
Stability: heat and light	8	8	7	8.5	7	6.5	8
Extraction: water, soap soln.	8.5	8.5	9.5	7.5	4.5	6	8
Extraction: oil (vegetable, mineral)	3.0	4	2	1	1	3	7
Volatility (carbon)	7	7	8	6.5	2.5	7	7
Relative Rating	47	46	48.5	46.5	40.5	42.5	52.5
Approximate Price Index* (Isosebacates = 100)	100	100	135	105	90	90	65

* Based on current (Aug. 1958) prevailing prices for finished plasticizers.

Esters of ISOSEBACIC® Acid Compare Favorably with Other Vinyl Plasticizers

Octyl esters of the new U.S.I. ISOSEBACIC Acid have been evaluated against accepted vinyl plasticizers in a complete series of tests at the U.S.I. laboratories. The performance results, expressed as relative ratings above, have been coupled with current price indexes to show comparisons which are meaningful to the maker of vinyl plasticizers. Here are the conclusions:

The octyl isosebacates are less expensive than sebacates and closely competitive in overall performance. They have an edge over azelates on cost and are about equal in performance. While comparing closely on cost with the adipates, they are better on overall performance. On specific properties, such as heat stability and resistance to extraction by vegetable and mineral oils, the octyl isosebacates are superior to other low-temperature vinyl plasticizers.

ISOSEBACIC Acid is a new synthetic intermediate made by U.S.I. — a mixture of the three C-10 dibasic acids: 2-ethyl suberic, 2,5-diethyl adipic and sebacic acids. It is not subject to the price fluctuations unavoidable with raw materials derived from natural products.

This valuable new intermediate will be available soon in commercial quantities from a new U.S.I. plant at Tuscola, Ill. Now is a good time to evaluate ISOSEBACIC Acid as a raw material for your operation. Send for pilot plant samples and technical data bulletins.

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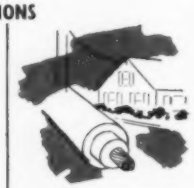
Multiwall bags and barrier papers

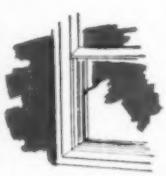
EXTRUSIONS



Wire and cable

Monofilaments for furniture tape

Monofilaments for rope and twine

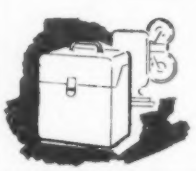


Contour extrusions

INJECTION & BLOW MOLDING

Bottles and packaging

Housewares



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indexes in combination with particular qualities for molding, extrusion, coatings and film applications. High flow rates—higher rigidity — heat resistance — grease and moisture impermeability — toughness —gloss—abrasion resistance and other properties are provided "as you want them." Check your Union Carbide Technical Representative—and, for the leaflet which lists all "BAKELITE" Brand High-Density Polyethylenes write Dept. DC143.

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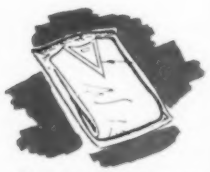

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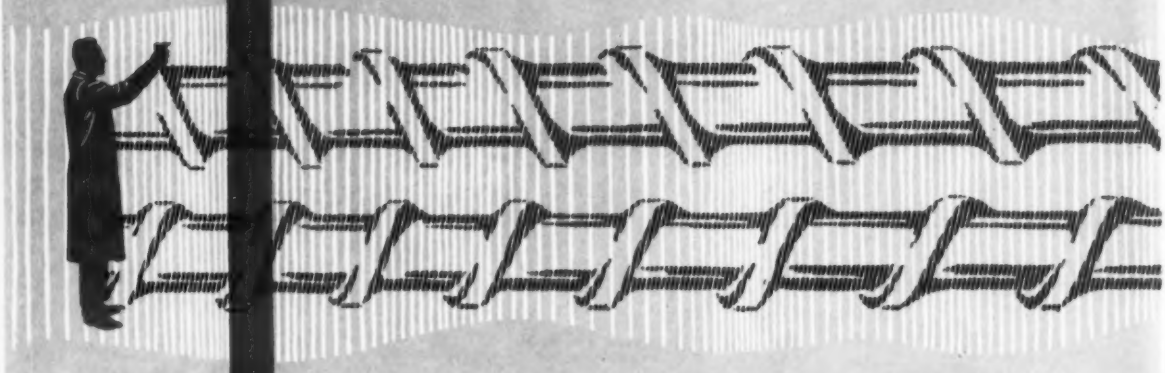
At The Right Place

Under The Right Conditions



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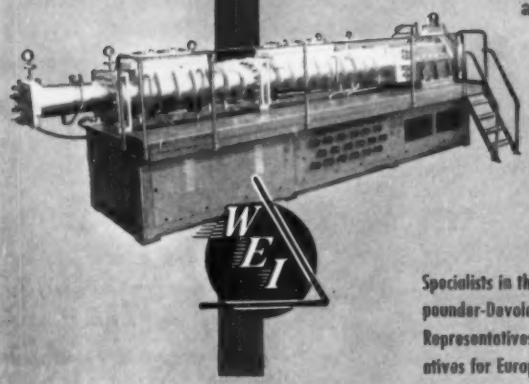

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PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

A New Look at Dry-Color Dispersion

A critical discussion of color-dispersion nozzles and design types for injection molding.

A. R. MORSE, *Sales Engr.*,
Injection Molders Supply Co.
Cleveland, Ohio

As manufacturers of all types of color-dispersion nozzles, we have followed for more than a decade the many developments affecting the designs and applications of these devices. One by one, more types have been added to those we stock, until now our new 1959-1960 Nozzle Catalog lists nine different kinds.

To these, add the "specials" we make every week according to this or that idea of how best to mix dry colors in the injection machine nozzle. As a result, we can show you records of well over 50 different styles of successful mixing or dispersion devices. A few of these are illustrated in Figure 1.

For the past decade, too, numerous articles have appeared in the trade papers on this specific subject. These articles all have one thing in common; each describes and illustrates a slightly different type of plug or mixer. Each one also produces illustrations of sample shots proving its superiority. Some of the articles show examples of unsatisfactory parts produced with other dispersion plugs or devices, many of which have been giving good results in the field for years.

We now have reached two definite conclusions about dispersion nozzles. Firstly, it is time that we took a new look at the problems of dry coloring. In the light of the many devices now available, it seems certain that there are many other factors besides the mixing nozzles that are affecting dry-coloring results.

Secondly, any good molder who believes firmly enough in a definite type of dispersion nozzle can use it to produce excellent results. Conversely, if the idea of the particular device does not appeal to him, he can produce ample evidence in the form of pieces showing poor dispersion to "prove" that the device is just plain "no good"!

This suggests that there must be many factors involved in successful dry coloring that may not involve the dispersion nozzle at all. While an ample literature exists on dispersion nozzles (see the partial bibliography appended), not nearly enough consideration has been given to the reasons why some mixing nozzles will perform excellently in one plant, and then fail in another.

A. Reynolds Morse was born in Denver, Colorado, and received a bachelor's degree from the University of Colorado in 1938, and a master's degree in production engineering from the Harvard Business School in 1939. From 1939-40, he was in glass machinery production with Hartford-Empire Co. From 1940-49, he was a sales engineer in the Cleveland, O., office of Reed-Prentice Corp. In 1949, he organized Injection Molders Supply Co. and has been its president since its inception. Mr. Morse is active in SPE and SPI, and founded the SPE Cleveland-Akron Section in 1944. He is the author of numerous articles of injection molding and related subjects.

With the single exception of the IMS Reverse Flow Mixing Nozzle shown schematically in Figure 2, every other type of mixing nozzle has originated either in the research laboratories of the various material suppliers, or with some injection molder. We find it impossible to make positive recommendations for one type over another. Therefore, we offer them all without bias or prejudice, and without any warranty that good results inevitably will follow.

Advantages of Dry Coloring

Dry coloring is based on the advantages inherent in maintaining only a single inventory of crystal or clear material. The impetus to dry coloring has varied widely over the years, depending on the price differential between pre-colored and clear plastics. The trend toward shorter runs and declining inventory investment, as well as the growing use of briefly-popular or high-style colors in plastics merchandising, all have boosted interest in dry coloring.

I will summarize, only briefly, the basic principles of dry coloring, since these all are covered excellently in various bulletins available from both the suppliers of the basic colors and the molding materials.

Proper granulation is vital; in general, the finer the better. Proper lubricants and wetting agents, together with correct tumbling procedures in properly-designed tumblers or blenders, are next in importance. Makeshift tumblers have given highly variable results.

Use of pneumatic or vacuum types of material hoists is highly questionable in dry-color molding. Not only are cleaning problems and costs high, but the devices actually remove colors. At the present time, there seems to be no way of overcoming the dust problem completely. If variable results are being obtained in your plant, materials-handling methods always should be reviewed carefully.

Color Concentrates

A fairly-recent development designed to minimize clean-up and dust problems is the use of color concentrates. These are super-color pellets which can be used in varying concentrations (ranging from 5-30%) with clears. Cost-wise, color concentrates often offer an advantage that is well worth investigating. Technologically, they offer no greater dispersion problems than do pigments.

They have the single disadvantage that the color concentrate must be compatible with the clear material used, thus limiting their applications, in general, to the same material family. Evaluation still is in progress to determine just how well color concentrates with certain melt indexes will mix with materials of other indexes or with linear types, for example, without causing stress-cracking or other signs of incompatibility.

Because of the concentrates' greater densities, segregation is possible in air and pneumatic types of material-handling devices. Therefore, these should be used only with discretion.

Variations in pigment density, not only from one color to another, but also from one brand to another, often will cause variable results (such as streaking, etc.). Moisture content and quality of the pigment used are factors that should be checked-out thoroughly when dispersion results are poor. Variations also are encountered between batches and brands of the molding powders themselves that often give rise to difficult dispersion problems even where excellent results previously were obtained.

To summarize, the molder should deliver a well-mixed, well-lubricated, finely-ground, uniform-quality feed to his press. Adequate quantities of good, heat-stable colorants should be used, since nozzle-mixing devices will not substitute for insufficient quantity of pigment. Finally, the molder should familiarize himself

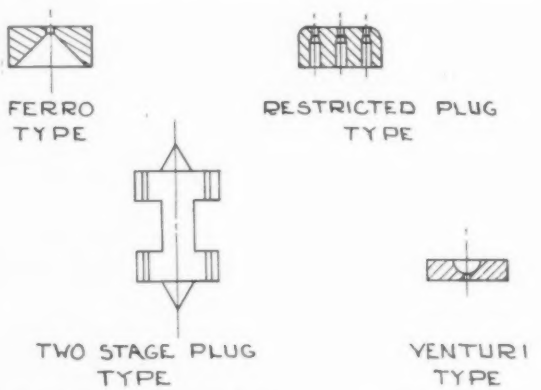

Fig. 1. Four basic types of dispersion plugs. (Schematic drawing—no scale).

with all of the variables described above that can cause puzzling variations in dry-color results.

Heating Chambers

No intensive studies have been made of what happens to dry colors in the various heating cylinders now in use. At no time since the inception of the injection molding industry some 20 years ago, have the original equipment manufacturers (now some 20 in number) been farther apart in the principles of proper heater design.

Basically, two types of heating chambers are found: long, thin ones; and big, fat ones. The watt densities, the wall sections of steel and plastic, and the exposure times as heat for the plastic material vary almost 100% between different heaters that are given the same popular or commercial nomenclature (eg., eight-ounce, 12-ounce, 16-ounce, etc.).

In recent papers, studies on our own new Reverse Flow Vented Heating Cylinders showed that viscous drag inside some types of heaters results in a complete segregation of pigment under certain zone temperature conditions. Layers of clear plastic from which the color has migrated completely are found adjacent to other layers of extremely dense color.

In certain types of cylinders, hang-up of color is observed at points where the inside diameter of the heater is changed or the flow blocked by barriers that divert the plastic into converging passages. This is due to the tacky nature of the melt and its failure to follow conventional liquid-flow patterns.

Turbulence of plastic flow varies widely with the make and model of heating chamber. In some heaters, no turbulence or drag can be demonstrated at all. In these, the plastic goes right through in a purely-undisturbed, laminar flow pattern. Some heaters introduce the heat gradually over a wide area. Other types pour most of the melting heat into the material just before it leaves the chamber. Dispersion nozzles are asked to overcome all this wide variety of conditions in the melt, but why do some types of nozzles work well while others do not under the same given set of conditions?

Variable Results

Variable results with dispersion devices stem largely from variations in demands made on the heating cylinder itself. A given 16-ounce heater, for example, is assumed able to run any size shot from 2-20 ounces. This heater is expected to plasticize from 10-130 pounds per hour of almost any material in cycles ranging from two minutes on heavy sections to 10 seconds on thin-wall parts. Thus, the viscosity of the melt in such a heater may undergo a range from a well-mixed, almost-liquid form to a virtually-solid, tacky mass.

Along the cylinder wall, we may observe a layer of gassy decomposition products due to the steel being so over-heated that it is literally boiling the plastic. On another run, however, the material may be sticking to the cylinder wall because it is being heated so slowly that it does not ever break away.

In an attempt to produce a uniform temperature of the melt outside the heating chamber, we developed a complete line of heated extension, dispersion, or terminal plasticizing nozzles (4).* They are designed to be used with individual heat controls. These nozzles were described in a technical article, that was submitted to a trade paper.

It was rejected, however, because it did not include laboratory tests of the various nozzles, even though dozens of these nozzles were being used in molding plants throughout the country. Some plants favored one design, while some material concerns favored another. We considered, and still do, that the principle involved in terminal plasticizing or evening-out the melt temperature is an important factor in dry coloring. Here, however, it is laboratory evaluation that need concern us chiefly.

Fallacies of Lab Tests

All too often, the injection molder has been led to believe that he can duplicate the test conditions and the good results reported by laboratory technicians with this or that mixing plug. Many a good technical service man, however, can testify quite eloquently that when he was up against an actual molding problem under the rather rough commercial conditions we face in this industry, he failed to produce the same results his laboratory achieved with a given plug or service.

Our own test installations have proved that so many variables can be brought to focus on a given installation that laboratory evaluation of color-dispersion devices is a highly-misleading formality, if not an outright waste of time. Conditions can be rigged much too easily.

Variations in shot size, cylinder temperature, nozzle orifice, and gate size, as well as gate location and cycle, all can be modified so as to obtain good results eventually with almost any kind of dispersion device. This is especially true when a "scientific evaluation" is sought. Almost invariably, such conclusions have fallen apart when commercial molding conditions are substituted. One must look more carefully at these variables.

Basic Nozzle Designs

Because of the wide variations in recommendations made for dispersion devices, many of them must be completely hand-made to order so that their costs often are high. In many cases, highly unrealistic specifications for hole sizes and other dimensions are given. Tolerances to less than 0.0001-inch are shown on triple-

*Numbers in parentheses refer to Bibliography at the end of article.

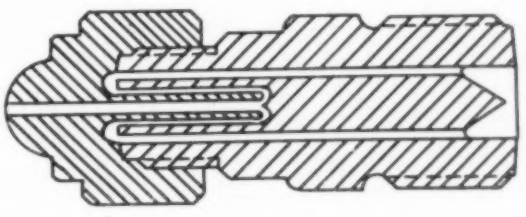

Fig. 2. Reverse flow dry-color mixing nozzle with heater, removable tip. (Schematic drawing—no scale).

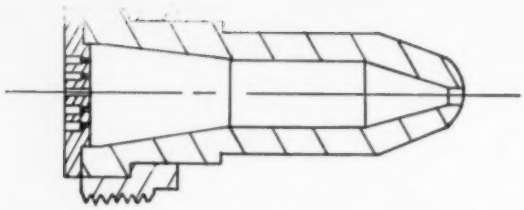

Fig. 3. Drawing of incorrect type of plug mounting where plug is placed behind nozzle seat.

scale drawings. Little attention is given to the cost of small-hole drilling, parts scrapped due to broken drills, and other manufacturing problems.

In some instances, recommendations are impractical because they are based on experience with only one type of nozzle. Our categories of Stock Nozzle Numbers is now up to 17, and this total does not even include the many Watson-Stillman and other types where the demand is too small or the nozzle type too specialized to permit anyone to stock them.

The result is that it often is quite impossible (for physical reasons) to adapt a given suggestion to suit every nozzle type. Lack of familiarity with the countless details of all the nozzles actually in use in the trade, therefore, is a source of much variation in dispersion performance. It is just not always possible to translate a given design from one make of nozzle to another.

At the request of Eastman Chemical, we recently searched our files of nozzle designs in the hope of discovering some type of plug or mixing device that could be simply dropped into any nozzle to obtain quick evaluation of a given dispersion problem by that firm's field representatives. So varied are the countless nozzle types that we reluctantly had to admit that no universal plug could be devised.

Some nozzles run very hot; some run fairly cold. Some nozzles are provided with their own separate heater bands and controls, while others are expected to pick up their heat by radiation from the cylinder body. Some nozzle-zone bands are controlled separately, while others are hooked directly into the front group of bands. In general, the use of individually-controlled nozzle zone and nozzle body bands is best. The use of Variacs or Powerstats for this purpose is highly satisfactory because of the difficulty in obtaining correct thermocouple readings and maintaining the thermocouple, even when fully armored, in the crowded nozzle zone.

Some nozzles are massive, weighing up to 10 or even 15 pounds, while others are tiny. Nozzle lengths run from ⅞-inch to 18-inches or even longer in some cases. Rear openings range from ⅜-inch to more than 1⅛-inches. Internal tapers and other internal design features are legion, as are external features. Yet it is within this range of specifications that the molder expects a dry-color device to be built that will give consistent dry-color dispersion for all of his different makes of presses!

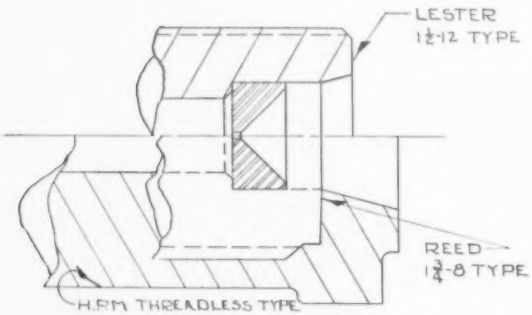

Fig. 4. Typical inset plug, ⅜-inch thick, shown in three popular nozzle types having ¾-, ⅞-, and one-inch rear openings. (Schematic drawing—double scale).

Current Status

Reduce Frictional Heat

Since almost all dispersion devices restrict material flow and build up huge back-pressures, they all generate considerable frictional heat. This heat is produced just prior to entry of the material into the mold. Where color dispersion devices can be eliminated entirely, heats can be reduced and cycles improved by three seconds or more since the plastic now can set-up faster. This is an important factor that all too seldom is taken into account when deciding whether or not to use dry colors as a measure of economy.

No evaluation has been made as yet of press downtime and extra heater maintenance costs occasioned by back-pressures from various dispersion devices. There is much evidence, however, that this is a factor often overlooked when plug details are being laid out. It is an intangible factor only until the heating cylinder cracks or leaks before the end of its normal life span.

Whatever mixing device is used, we have found that there is only one cardinal rule: Under any conditions never use the type of plug that is pinched between the nozzle and the nozzle seat. There are many reasons why this should never be done. Nozzle seats have a precision crown for a good seal. We have seen several heaters burst open unnecessarily because the plug fell down and blocked half the holes, while the remainder were plugged with tiny metal particles.

Irreparable damage to the precision crowns of nozzle seats can ruin whole heating chambers costing thousands of dollars. Finally, nozzles must take a terrific amount of abuse. When the thread-holding area is reduced by ⅜-½-inch (or whatever is the plug thickness), nozzle threads easily can be over-loaded and so quickly ruined. An incorrect type plug insert is shown in Figure 3.

Inset All Plugs

We suggest that all mixing plugs be inset into a properly-cut recess in the back of the nozzle. All such devices preferably should be loose-fitting so that removal for cleaning can be done easily. This means that plastic suck-back must be controlled by proper nozzle and gate freezing, and the use of small, quick-

setting sprues to avoid misplacing the insert.

Figure 4 shows a typical dispersion plug inset into three basic nozzle types where the same diameter plug is adapted to fit nozzles with three different rear openings. Figure 5 illustrates a Dow-suggested ball check-type nozzle to eliminate the above-mentioned suck-back that sometimes causes bottom-sink in some parts just over the sprue. This type of ball check should not be confused with the shut-off or anti-drool types (see Figure 6) designed to restrain material flow between cycles and permit a pressure build-up in the heater just prior to injection.

Many engineers have recommended plugs from 3/16-1/4-inch thick. These thin plugs have the following two disadvantages: (1). they are easily bent or damaged; and (2). they too easily are sucked back and displaced by normal reverse or elastic movement of the plastic when injection pressure is released. We recommended that plugs be from 3/8-1/2-inch thick, and set in suitable recesses from 1/2-5/8-inch to avoid displacement.

Whatever design is selected, we believe that back-pressures and frictional heat factors should be given paramount consideration. Use of dispersion holes or venturis of as large a size as possible means that cylinder heats can be lowered and faster cycles used. Venturi's orifices, holes, etc., should be enlarged gradually, even at the cost of ruining an insert to determine just where dispersion results actually begin to fall off on a given job (5).

Trial of several different devices also is suggested to determine just which is best with a given heating cylinder and material type. A small investment in local evaluation of all the recommended devices can pay big dividends in faster cycles; fewer split, cracked, or leaking heaters; and in better, easier color dispersion.

Pigment Segregation

Many currently-used dispersion devices have been designed so as to produce momentary segregation of pigment as the plastic enters the restrictions provided. This is demonstrated easily by inspection of the nozzle insert after specks, streaks, or unmixed color zones are observed in the molded article. Such inspection will show that the pigment has piled up on the nozzle insert in some cases, and is impacted there while the plastic flows by it.

Color pigments in and of themselves have no flow properties. Pure pigment with no carrier plastic would not flow at all. When this clear-cut segregation of pigment occurs in the heater or in the nozzle mixing device, little can be done except to change the job to a larger or smaller machine which has a cylinder that does not produce zonal segregation of pigment. Also, the basic mixing device should be changed to another design.

As a final resort, we suggest use of a completely-different design of heating chamber. Its capacity should be balanced carefully to the plunger size, displacement, type of material, and size of shot. This may even mean the need for a new plunger and feed cylinder as well, since both bulk factor and injection pressure are involved in color dispersion. Plunger speeds must be reviewed, too, to increase the material's rate of travel through the chamber and increase its turbulence, while minimizing the effect of laminar flow.

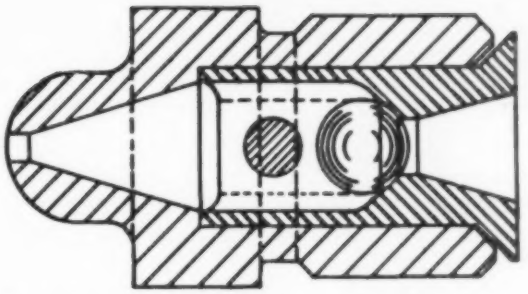

Fig. 5. Dow anti-suckback nozzle to prevent bottom-sink. (Schematic drawing—no scale).

Conclusions

One leading field service engineer who reviewed this article commented that it posed a problem, but offered no solution. It cannot be denied that those of us concerned with dry-coloring problems have run into many situations where there seems to be no definite solution. The purpose of this article, therefore, has been to suggest where these hidden difficulties may be found. When a nozzle-mixing device does not cure a problem, a change of heating cylinders, a change of brand of material and color, a change of nozzle device, and a thorough review of material-handling techniques all are in order.

Sooner or later, we expect a definite pattern to emerge from the present welter of dispersion devices. Already, we have a few ideas as to which devices work best on certain machines with certain types of molding powders for certain kinds of work. Until these can be formulated, each application must be studied individually and related to already-proven plugs, discs, and inserts.

Dry coloring can be done successfully. When present dispersion devices fail, it may not be the fault of the mixing nozzle, but of some other process factor. There have been more axes ground on this subject than even the questions of mold venting, mold gating, core support, core cooling, or other controversial problem areas where machinery, mold, and material combine so that no one factor can be considered as the final determinant. There are many experts in dry-coloring today, and you can find as many answers to your dry-coloring problems as there are experts! *(Continued on page 42)*

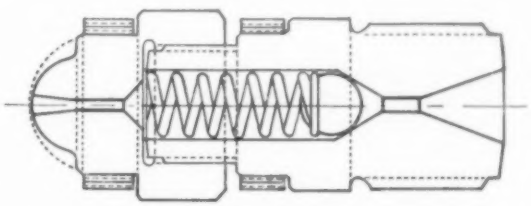

Fig. 6. Ball-type shut-off or anti-drool mixing nozzle with heated, removable tip. (Schematic drawing—full scale).

(left)
R. J. MEYER, *Senior Development Engr.,*
and *(right)*
DONALD ESAROVE, *Development Engr.,*
B. F. Goodrich Chemical Co.
Development Center,
Avon Lake, Ohio

High-Density Cellular Vinyl by Direct Extrusion

Gas can be incorporated into an extruded vinyl compound by means of a direct-extrusion method, using conventional equipment.

COMMERCIAL products with densities from 5-125 pounds per cubic foot are being produced from vinyl resins. At the low end of the density spectrum are the unicellular vinyl sponges and vinyl foam products. The high end of the spectrum is occupied by materials such as the loaded vinyl extrusions (See Figure 1). As is indicated by the direction of the arrows in Figure 1, the desire for cost reduction has resulted in a diverging pattern of interests and developments.

Producers of vinyl foam and unicellular vinyl sponge are interested primarily in lower density per se. On the other hand, many manufacturers of vinyl extrusions have added more and more high specific-gravity fillers to lower the costs of their compounds. As a result, the area in the density spectrum between 10 and 75 pounds per cubic foot has been subjected to very little detailed investigation, either with respect to development of new techniques or methods to process vinyl materials at these density levels or to characterize the products therein.

In a program designed to develop new methods of expanding vinyl to give cellular products within this under-developed area, two specific vinyl extrusion methods based on the use of blowing agents were developed which effectively divided this area into high-density cellular vinyl at 40-75 pounds per cubic foot density and low-density cellular vinyl at 7-40 pounds per cubic foot. This paper is limited to the first of these two areas, and products in this range have been designated arbitrarily as high-density cellular vinyl.

Compounding

The production of high-density cellular vinyl products is based on a direct-extrusion method in which a small amount of blowing agent is incorporated into a vinyl compound. During extrusion, this blowing agent is completely decomposed to liberate gas within the barrel of the extruder. Ultimate expansion occurs upon emergence of the plastic mass from the extrusion die.

Fillers and Extenders

Fillers and extenders commonly are used in vinyl extrusion products, largely to produce a lower-cost product with a minimum loss of physical properties. As a result, low specific gravity is a desirable characteristic of a filler.

Unfortunately, the low specific-gravity fillers normally are associated with a very high oil-absorption value. Oil absorption is used in this case to describe the plasticizer-absorbing tendency of the filler. This tendency creates a situation where both the vinyl resin and the filler compete for the available plasticizer. The addition of more plasticizer to compensate for this factor results in the further lowering of physical properties.

Therefore, the choice is limited, in effect, to fillers with minimum oil absorption values. A compromise of specific gravity versus oil absorption properties is apparent in the wide use of calcium carbonate and clay as fillers for vinyl compounds. A diminishing effect on volume-concentration loading is observed upon the addition of increasing amounts of these solid fillers (see Figure 2).

All fillers reduce the over-all physical properties of an extruded vinyl compound in proportion to the percent volume concentration added. The degree to which the properties are reduced for any particular filler will depend very largely on such factors as pigment particle size and shape, oil absorption value, agglomeration tendency, etc. We can consider the practical use of fillers in vinyl to exist in a range of from 0-400 parts filler to 100 parts resin on the basis of weight. This may be related to the use of 0-28% volume concentration of clay or 0-36% volume concentration of calcium carbonate in the vinyl compound, as shown in Figure 2. The percent volume concentration of the filler in a compound is calculated on the basis of the specific gravity of each ingredient.

NITROGEN GAS FILLER. The cellular plastic industry is accustomed to evaluation of products in terms of volume relationships. It then is possible to consider the nitrogen gas cells as a dispersion of inert voids in the over-all vinyl structure, just as the individual inorganic pigment particle is considered a dispersion of inert particles in the over-all structure. However, in the case of low-density cellular products, the percent volume concentration of gas is extremely high (more than 90%) with reference to the total solid mass.

On the other hand, high density cellular vinyl produced in a density range of 40-75 pounds per cubic foot does compare in percent volume concentration of gas with those compounds filled with up to 400 parts solid filler per 100 parts of resin.

Since gas under these conditions and in these quantities exists as a dispersion of inert voids in the plastic mass, it may be considered a filler or extender for the vinyl compound. Indeed, it is a most unusual filler by contrast to the normal loading materials, but to a major degree fulfills the requirements we have outlined in Table 1 for an optimum filler of low-density and low oil-absorption properties.

Table 1. Physical Characteristics of Vinyl-Loading Materials

	Nitrogen Gas	Clay	Calcium Carbonate
Density, lbs./cu. ft.	.078	162	169
Shape	Indeterminate	Fixed	Fixed
Aver. particle diameter, Microns	Indeterminate	1.7	2.5
Compressibility	High	None	None
Oil absorption, gms./100 gms.	None	25-35	14-16

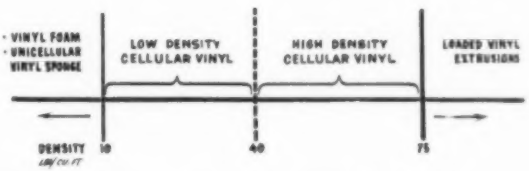

Fig. 1. Density-range spectrum for cellular vinyl products.

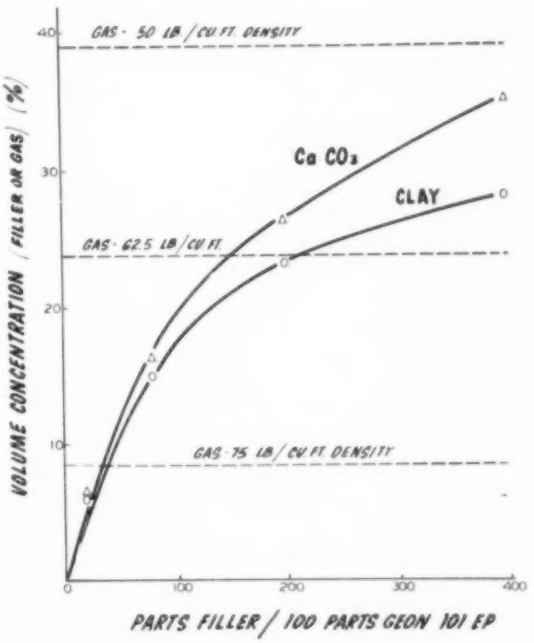

Fig. 2. Gas vs. solid fillers for volume loading of a vinyl compound.

Whereas a solid filler generally is dispersed uniformly throughout the vinyl cross-section, gas is unique in that it tends to concentrate in the areas of largest cross-section, thereby developing outer skins.

The object of this investigation, therefore, becomes that of a direct comparison of nitrogen gas as a filler for a vinyl compound with common solid fillers (such as clay and calcium carbonate).

Vinyl Formulation

Although a wide range of vinyl compounds from very soft to rigid materials have been filled with gas in this manner, for the purposes of direct comparison a typical unloaded vinyl extrusion compound with a Shore "A" hardness of 75 and 60-part plasticizer level was chosen as follows:

Material	Amount, PHR
Vinyl resin:	
Geon 101 EP	100
Plasticizers:	
GP-261 (Dioctyl phthalate)	40
Butyl benzyl phthalate	20
Stabilizer:	
Basic lead, silicate-sulfate	10
Lubricant:	
Paraffin wax	0.5
Blowing agent:	
Azo dicarbonamide	Variable
Fillers:	
Calcium carbonate	Variable
Clay	Variable

Unless otherwise stated, plasticizer compensation in the loading studies was made with GP-261 added on the basis of 36 parts per 100 parts calcium carbonate, and 66 parts per 100 parts clay.

Blowing Agent

Most extruded product manufacturers have a preference as to the physical form of an extrusion compound containing blowing agent, whether it be a powder, cubes, granules, or in the form of a strip. Individual preferences may be dictated by such factors as availability of mixing and extrusion equipment.

All types of blowing agents are characterized by a temperature at which decomposition occurs in air. This temperature is lowered in varying degrees by the vinyl compounding ingredients. Any temperature experienced during the preliminary mixing steps must be lower than the activation temperature of the blowing agent in the compound in order to be processed. In many cases, the method of mixing will be specified by this limitation.

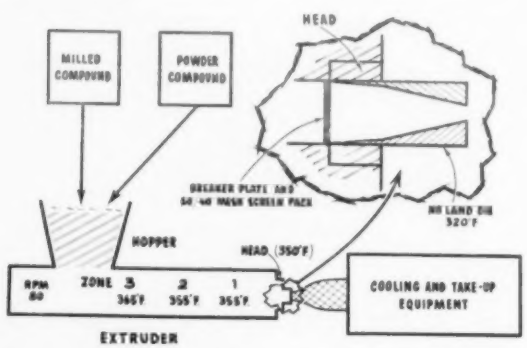

Fig. 3. Schematic flow-sheet for high-density cellular vinyl extrusion.

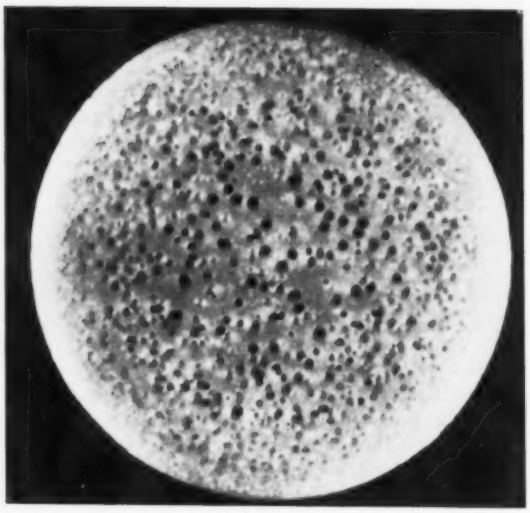

Fig. 4. Cross-sectional photomicrograph (15X) of high-density cellular vinyl.

Three methods are used for introduction of the small amounts of blowing agent involved in this process:

(1). Mill mix preparation.

When it is desired to incorporate the blowing agent into the granules or in cases where the extruder is being strip-fed, those blowing agents with high activation temperatures (above 300° F.) may be milled into the vinyl batch as a final step in the normal milling procedure. The stock temperature at the time of addition should be at least 30-40° F. lower than the activation temperature of the blowing agent in the vinyl compound. This will eliminate the possibility of premature activation of the blowing agent during processing.

(2). Powder mix preparation.

The blowing agent normally is added as the final ingredient in the powder mix preparation after the temperature of the batch has been reduced to room temperature. In the case of those blowing agents with an activation temperature of 300° F. and above, the addition may take place at any time during the powder mix-preparation cycle, since the compound temperature normally is 180-220° F. The mixing equipment must be grounded adequately to prevent build-up of a static charge.

(3). Tumble mix addition to granules or powder mix compound.

Mixing is done at room temperature; therefore, any of the four types of blowing agent can be used. A ribbon blender, in the case of powder mix, or simple drum mixing equipment of the rotary or planetary type for the granulated compound, may be used in a manner normally employed for the dispersion of

color pigments on neutral colored compound. The only precaution to be observed in this operation is that the equipment be adequately grounded.

Storage Stability

Compounds containing blowing agent or coated with blowing agent have been stored for periods of several months without apparent loss of gas-producing capacity.

When a compound containing blowing agent is stored for a long period of time, reasonable precautions will prevent the loss of gas. Under these storage conditions, it is best to use a blowing agent that has a high activation temperature. A surface-coated granule system will permit less contact between blowing agent and plasticizer than does a powder mix blend due to total available surface considerations. The storage area should be cool and out of direct contact with sunlight, steam lines, or other sources of localized high-heat conditions.

Extrusion

All experimental work was done on a 2½-inch vinyl extruder. A typical set of conditions for operation of this equipment on the standard compound (mentioned above under "Vinyl Formulation") where the blowing agent is incorporated into the granules by the mill-mixing method is detailed in the schematic extrusion flow sheet shown in[1]Figure 3. Since granules were used, the extruder was equipped with a standard low compression screw having the following characteristics:

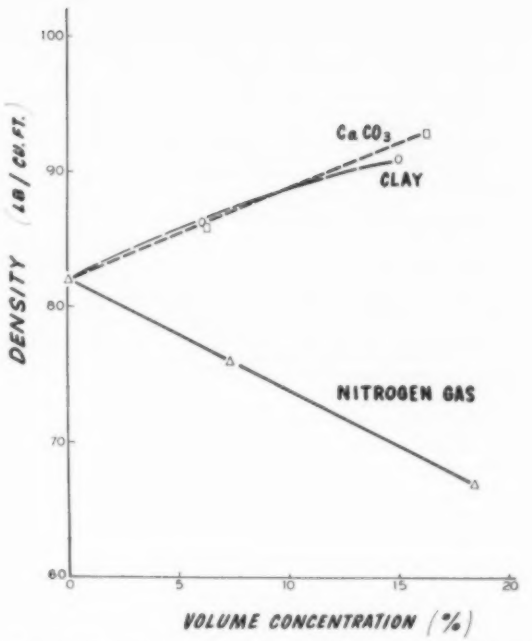

Fig. 5. Effect on density of gas and solid fillers for volume loading of vinyl.

Compression ratio = 2.17:1
Length/diameter ratio = 17.5:1
Constant-pitch, decreasing-depth screw

Table 2. Effect of Blowing Agent Concentration on Properties*

	Parts Blowing Agent/ 100 Parts Geon 101 EP			
	None	0.1	0.4	0.5
Volume concentration, %	0	7.3	17.7	32.9
Density, lbs./cu. ft.	82	76	67.5	55
Hardness, Shore "A"	75	76	72	67
Tensile strength, psi.	1,900	1,900	1,350	1,100
100% Modulus, psi.	1,000	950	700	600
Elongation, %	300	310	260	250
Lupke rebound, %	19	16	18	17
Water absorption, %	0.21	0.23	0.29	0.40

*All testing was performed on ¼-inch diameter rod specimens.

Table 3. Effect of Loading On A Standard Compound Containing 0.5 Part Of Blowing Agent*.

	Parts of Calcium Carbonate/ 100 Geon 101 EP			
	0	20	40	80
Density, lbs./cu. ft.	55	70	72	76
Hardness, Shore "A"	67	71	74	76
Tensile strength, psi.	1,100	1,400	1,450	1,150
100% Modulus, psi.	600	800	850	800
Elongation, %	250	240	220	210
Water absorption, %	0.40	0.16	0.16	0.33

*All testing was performed on ¼-inch diameter rod specimens.

Extrusion temperatures were employed which permitted the optimum mechanical working and fluxing of the plastic mass and insured the complete decomposition of the blowing agent. The barrel and head temperatures were normal for a solid vinyl compound of the same plasticizer content. The die temperature was maintained 40-60° F. cooler than the stock temperature. A screen pack containing a 60- and a 40-mesh screen has proved to be adequate for extrusion of the granulated compound.

It will be noted in Figure 3 that the compound expands immediately upon emerging from the die. Expansion is complete within several inches from the die surface at normal extrusion speeds so that the extruded shape can be carried immediately into a water bath for cooling. Normal take-up procedures were used in all cases.

Pressure conditions within the extruder are such that when the blowing agent is decomposed, it cannot expand freely but exists in a dissolved form within the fluxing plastic mass. As a result, excellent distribution of gas occurs even in those cases in which the blowing agent has been tumble-mixed onto the surface of granules. At the point of emergence of the plastic mass from the die, the gas is free to expand within the compound. The rate of expansion is so rapid that a very high shearing force is exerted tangentially to the die edge by the expanding compound. The result may be surface tearing of the extrusion, producing a very rough-skinned product. Proper processing conditions can eliminate this surface roughing.

The most critical factor in the formation of smooth skins involves the design of the die for use in the process. It has been found that a die with a short land or, preferably, without any land produces products with the smoothest surfaces. A land is defined as the taper-free section in the die just behind the point of plastic emergence. A constant-taper, no-land die as sketched in Figure 3 is representative of a desirable die design.

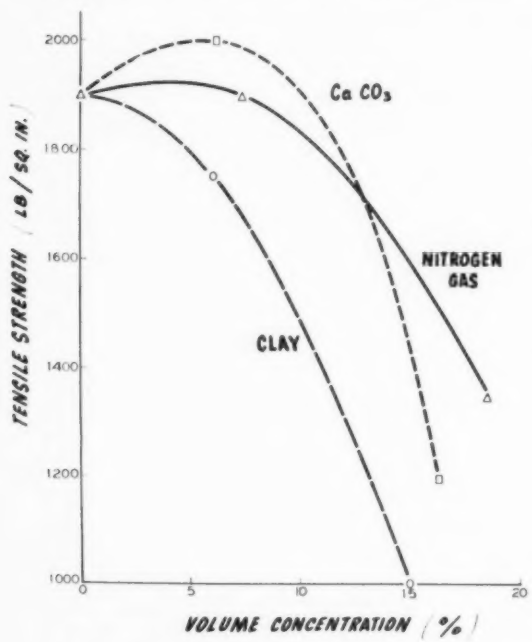

Fig. 6. Effect on tensile strength of gas and solid fillers for volume loading of vinyl.

In addition, the following three operating conditions have a bearing on the quality of the surface formed.

DIE TEMPERATURE. A cool die (40-60° F. below stock temperature) will tend to congeal that portion of the plastic mass which will become the surface of the product. This will increase the skin strength at emergence from the die, with a resultant decrease in the possibility of tearing. A cool surface layer also affects the distribution of gas in the cross-section, influencing the gas to collect in the center of same.

EXTRUSION SPEED. Extrusion at high speeds is recommended as an adjunct to a properly-designed die. The shearing forces applied tangentially to the die edge are lowered further by rapid removal of the expanding plastic mass from the die.

TEMPERATURE CONTROL. The vinyl compound should never be overworked in the extruder; that is, rendered too fluid by use of excessively high temperatures and/or the use of too fine a screen pack. Gas-filled compounds tend to be more fragile when hot than are the clay- or calcium carbonate-filled compounds, and will tend to surface roughen more readily until cool. Less strenuous operating conditions are called for when gas has been added without plasticizer being removed for compensation. The gas acts like a plasticizer during processing.

Effect of Gas Loading

A gas-filled extruded compound produces a unique product. Distribution of gas cells is such that the cells in the center of a cross-section are larger, and the cells closer to the skin are small, while the skin itself is gas-free. Figure 4, a cross-sectional photomicrograph shows that the cells tend to be discrete and closed. The unique structure produced by this method accounts for many of the physical-property characteristics of the material.

When variable amounts of azo dicarbonamide are added to the standard compound, a direct evaluation of the influence of gas cells on the physical properties of an extrusion may be obtained. In Table 2, it is seen that only 0.5 part of azo dicarbonamide are required to give effectively a 33% volume-concentration gas loading. This is equivalent (on a volume basis) to the use of about 400 parts of a calcium carbonate filler.

As the amount of blowing agent is increased, the following property changes occur:

(1). The density of the product decreases.

(2). The hardness of the extrusion decreases, since gas is a compressible filler. The softening effect necessitates the removal of plasticizer when compounding to a specific hardness value.

(3). Tensile strength and 100% modulus decrease at a rate proportional to the increase in blowing agent added. Tensile strength and modulus can be increased by the removal of plasticizer to compensate for the softening effect of the gas. This was not done in this

portion of the study.

(4). The decrease in elongation is small. If plasticizer had been removed, the decrease would be more significant.

(5). Lupke rebound and water absorption values failed to show significant changes. The lack of significant change in water absorption indicates a closed cell structure.

Effect of Calcium Carbonate Addition

In order to determine the effects of a solid filler on a gas-loaded compound, 20, 40, and 80 parts of calcium carbonate (uncompensated) were added to a compound containing 0.5 part azo dicarbonamide, with the results shown in Table 3.

The absorption of plasticizer by calcium carbonate effectively removes a portion of the plasticizer from the system. This absorption results in a situation similar to that which occurs if plasticizer were removed to compensate for the softening effect of the gas. Thus, initially, the major changes noted are an increase in hardness, an increase in tensile strength and 100% modulus, and a decrease in elongation. The optimum level of calcium carbonate appears to be slightly above 40 parts. Above this level, the weakening effect of the filler over-balances the increase in physicals due to plasticizer absorption, resulting in a drop in physical properties.

At the 40-part calcium carbonate level, it will be noted that the hardness has been increased to a level representative of the unloaded compound (see Tables 2 and 3). It is seen that by direct comparison at these equivalent hardness levels, a gas and calcium carbonate-loaded compound can be formulated which evidences properties only slightly lower than those of the unloaded compound.

It is standard practice in the extrusion industry to formulate products to a constant hardness value. A direct comparison was made between the various loading agents at equivalent volume concentrations and at a constant hardness value. In order to compare gas as a filler with clay and calcium carbonate, plasticizer compensation was necessary. All data reported was for ¼-inch diameter rod specimens.

Figure 5 details the diverging effects on density of the addition of solid fillers as opposed to gas loading. The reduction in density with gas loading provides advantages in shipping costs for finished products, as well as physical advantages in many applications where total construction weight is of importance (such as cable construction).

The addition of all fillers ultimately reduces the tensile strength as the volume concentration of the filler increases (see Figure 6). It is noted that although nitrogen gas also results in a loss of tensile strength (at loading levels above 15% value concentration), the rate of loss is lower than with the use of clay or calcium carbonate.

In many applications of extruded shapes such as spline and gasketing, 100% modulus is of much greater importance than tensile strength. Gas has a lesser effect in lowering 100% modulus than either of the solid

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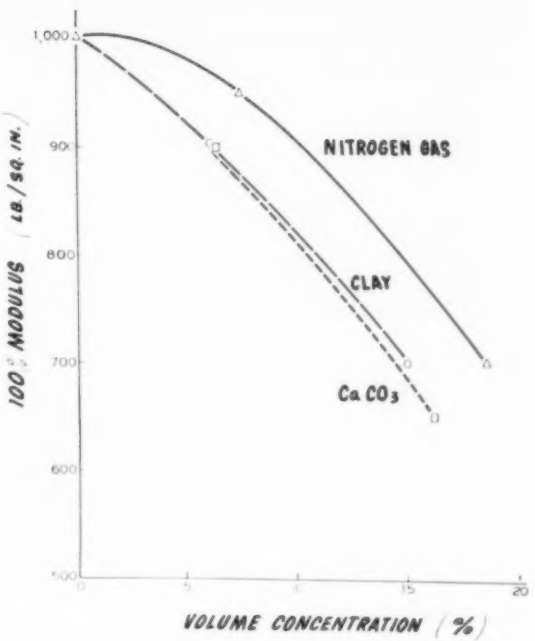

Fig. 7. Effect on 100% modulus of gas and solid fillers for volume loading of vinyl.

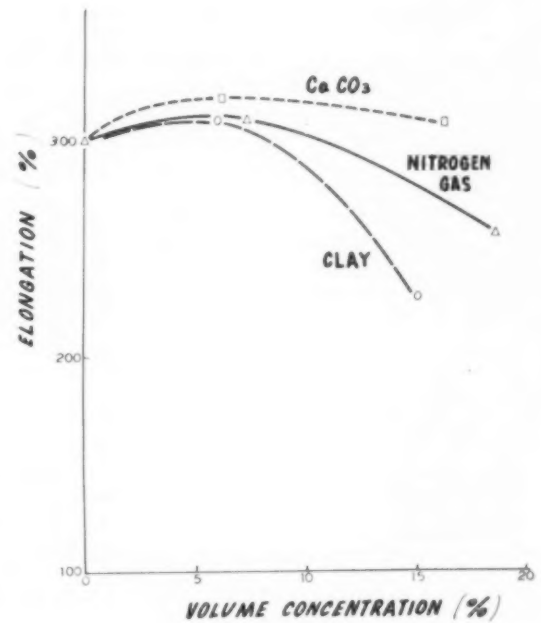

Fig. 8. Effect on elongation of gas and solid fillers for volume loading of vinyl.

Guest Editorial

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Potentials for Diversification of the Post-Thermoforming Industry

THE post-thermoforming (vacuum forming) industry, one of the newest offsprings of the plastics industry, is entering the realm of experimental science with its conflicting theories and practices. Men with inquiring minds are faced with the challenge of tackling the next higher step upwards toward a solution, and should not allow themselves to become sidetracked by insignificant details.

Industrial conversion has become an established fact. However, the custom molder should not overextend himself in the field of proprietary molding without establishing proper policies. Determination and dedication to exploratory investigation of new areas should, however, increase.

Translating theory into fact involves pitfalls, but this embryonic industry has already set astounding records. Still others can be expected to occur at any time. We can enumerate the many processing techniques, which have stemmed mainly from the thermoforming equipment and machinery development centers, as follows:

Mechanical forming
Matched die forming
Free blow forming
Female draw forming
Draping
Trapped-sheet forming
Plug-assist forming
Plug-ring forming
Wrap-around forming
Air-slip forming
Snap-back bottom forming
Inverted draping
Air-pressure forming
Air-cushion forming

The order in which these techniques appear is random, and not in chronological sequence. Equally numerous are the applications of modified techniques and processes, as well as combinations of dissimilar techniques (e.g.; R. F. sealing methods), plus a number of analogous techniques like cycle-integrated thermotrimming.

While the majority of current applications for thermoforming are in packaging, a major break-through into fields as yet untapped by thermoforming, or even by plastics, can be anticipated. Past experience points to an over-production of items of waning popularity using well-established materials. No amount of "hard or soft-sell" advertising seems able to reverse a trend; therefore, new frontiers must be sought.

The most interesting new materials which may provide just the right impetus are the high-density polyethylenes, polypropylenes, or polyolefines. As early as 1955, I conducted experiments with low-density

(Continued on page 47)

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Brushable Resurfacer for Fiberglass Panels

A coating is described that can be brushed on weathered panels to refinish them and restore their original appearance.

FIBERGLASS-REINFORCED polyester panels, first produced commercially about 1947, have grown to where approximately 50-million square feet are sold annually. Most of this material is used in outdoor industrial applications as skylighting, sidewall lighting, and window glazing, and in outdoor residential applications for awnings and patio covers. Fiberglass polyester panels have properties which make them ideal for these applications because of their light weight, ability to be colored, and ease of forming to shapes or configurations to match metal roofing or siding.

The large majority of the material sold in the past, and much of what is sold today, tends to discolor and erode (show glass surface fibers) on outdoor weathering. In the last few years, improvements in the quality of the resin, light stabilizers, and pigments have resulted in panels with reduced tendency to yellow. Several manufacturers now have quality panels on the market utilizing a surface mat, a resin-rich surface, or special monomers to give reduced fiber show upon prolonged exposure.

It is common practice, however, to coat the material every few years with a plastic lacquer of which several types are commercially available in color. Generally, however, these lacquers are suitable for spray application only, and spraying may be impractical, if not impossible, for the home owner or small jobber wishing to coat or refinish fiberglass panels. Chemiglas, therefore, developed a coating that can be brushed on to refinish weathered panels and restore the original appearance.

An examination of the uses for fiberglass panels in-

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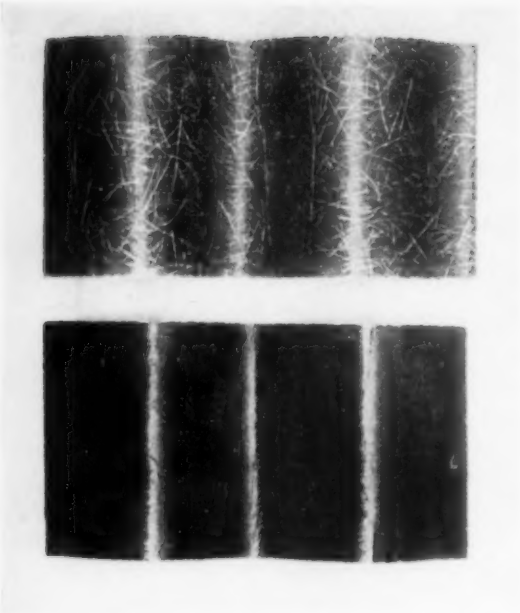

Weathered, blue translucent panel of glass fiber-polyester before (Upper) and after (Lower) application of the blue Brushable Resurfacer coating.

dicates that a coating of this type should have all of the following eight properties:

(1). It must be available in translucent colors.
(2). It must be brushable.
(3). It must dry showing no streaks, laps, or brush marks after drying.
(4). It must have good light-stability in itself.
(5). It must have good scratch resistance.
(6). It must have good adhesion to the panels.
(7). It must have good weather resistance.
(8). It must withstand relatively wide temperature variations.

Initial development work was carried out using acrylic-base materials, since these normally are considered to have excellent weather resistance. This was found to be the case in clear coatings, except that the coatings tended to break down and pit at conditions of elevated temperature and moisture as are present in accelerated weathering equipment. To overcome this, the acrylic was combined with a modified polyester resin. Formulations were developed for clear and four basic colors—blue, green, white and yellow—using varying amounts of these two base materials and solvents to give a viscosity (eight centipoises) similar to commercial lacquers. This gave a drying rate slow enough to allow even flow-out of the coating which, in turn, eliminated brush marks and streaks. Formulations also have been developed recently for sand and coral colors, and these are included in portions of the following discussion.

Test Program

The fiberglass-reinforced polyester laminates used as a base for the coatings in these tests were commercial panels weighing approximately eight ounces per square foot, with a thickness of 1/16 inch, and having flat, smooth surfaces on both sides. For purposes of testing and having a uniform base material, the panels were new and not previously weathered. Weathered panels were obtained to determine appearance and flow, but were corrugated and could not be used with any degree of reliability for tests.

The coatings were applied to laminates by brushing while the laminate was held in a 1:3 slope position. The coatings were allowed to air-dry at least 48 hours, but less than 188 hours prior to testing. Admittedly, this brush application may result in less uniform application than the use of a doctor blade or similar applicator, but brush application was considered desirable in this case so as to simulate actual usage.

Test Results

Fadeometer Tests

Coatings were applied to white laminates and exposed on a Fadeometer to measure the yellowing and discoloration. The Fadeometer consists of three RS Sunlamps mounted on a triangle form six inches above a rotating table. The heat from the lamps maintains the temperature on the table at 60° C. The coatings were exposed for periods of 96 and 192 hours, along with an uncoated laminate as a control. Although Fadeometer test results have rather poor correlation with outdoor exposure results, previous experience indicates that in this particular Fadeometer, 96 and 192 hours are equivalent to roughly 1½ and three years outdoor exposure, respectively. The results of a visual examination of the test specimens are presented in Table 1.

Weather-Ometer

Coated laminates were tested in an Atlas Twin-Arc Weather-Ometer in accordance with ASTM Method E42-55T (Type D equipment). A cycle of 102 minutes of arc light, followed by 18 minutes of light and water spray was used. The results of these tests are presented in Table 2, based on a visual evaluation of the laminates for exposure periods of up to 1,000 hours. As in Fadeometer testing, correlation with outdoor exposure is quite rough, but it is estimated that for polyester laminates, 1,000 hours of accelerated weathering is equivalent to two or three years outdoor exposure.

Scratch Resistance

The surface hardness or scratch resistance of the coatings was tested by a method similar to the Wilkinson Pencil Test. In this test, lead pencils of varying hardness are drawn uniformly across the coating surface with equal pressure until the pencil is found that will just cut the coating without marking the material underneath. The pencil number is then used to express the scratch resistance of the coating. This test is subject to many variables and to eliminate as many as possible, extreme care was taken to apply uniform pressure, use a constant angle of contact, and pencils were sharpened before each test. Eagle Chemi-Sealed

Table 1. Fadeometer Test Results with C-1 Brushable Resurfacer*

Exposure Time, Hrs.	Effects on Color of Resurfacer				
	Uncoated	Blue	Green	White	Yellow
96	Slight yellowing	Very slight yellowing	No change	Slight yellowing	No change
192	Appreciable yellowing	Slight yellowing	Slight yellowing	Slight yellowing	Slight yellowing

*New white laminate used as the base material and as the uncoated control.

Table 2. Weather-Ometer Tests With C-1 Brushable Resurfacer.*

Exposure Time, Hrs.	Uncoated	Blue	Green	White	Yellow
Effect on Color of Resurfacer:					
500	No change	No change	No change	No change	No change
832	—	Very slight change	Very slight change	—	Slight color change
1,000	Slight yellowing	—	—	Very slight yellowing	—
Effect on Gloss of Resurfacer:					
500	—	No change	No change	No change	No change
832	—	No change	No change	—	No change
1,000	Slight fiber show	—	—	No change	—

*New white laminate used as the base material and as the uncoated control.

Turquoise drawing pencils were used for all tests.

The scratch resistance was measured on laminates coated and dried for at least 48 hours, and again on the same laminates after two-hour immersion in boiling water and subsequent 24-hour drying. The results of these tests are presented in Table 3.

Water Resistance

As described in the previous section, coated laminates were immersed in boiling water for two hours. The coatings remained intact, although temporarily losing their hardness. Upon removal from the water, the coating could be scratched off in flakes and small pieces, although it could not be peeled off in large pieces. After drying for 24 hours, the coatings could not be scratched off, and appeared to regain their original properties to a great extent.

Control laminates also were subjected to a 30-day immersion in water at room temperatures of 65-75° F. Scattered small blisters began to appear after about 10 days immersion, and gradually the entire surface was covered by small blisters. After 3-5 days immersion, the coating could be scratched off while still wet. When the samples were removed from the water after 30 days and allowed to dry for 48 hours, the coatings appeared to regain their original properties to a great extent, and could not be scratched off.

Table 3. Scratch Resistance with C-1 Resurfacer.

	Pencil Hardness to Scratch Resurfacer			
	Blue	Green	White	Yellow
Original coating	8H	8H	8H	8H
After 2-hour boil	5H	5H	5H	5H

Table 4. Effect of C-1 Brushable Resurfacer On Light & Heat Transmission Of New, Clear Fiberglass Panel

Resurfacer Color	Reduction in Transmission, %	
	Light*	Radiant Heat**
Clear	0	0
Green	12	0
Blue	27	5
Yellow	9	6
Coral	35	12
White	7	14
Sand	20	20

* Measured in accordance with ASTM D1494-57T.
**Measured with a G-E Radiation Meter, Type DW-60.

Temperature Resistance

Coated laminates were subjected to 150° F. for eight days with no apparent change in the color or gloss. After this subjection to elevated temperature, the same specimens went through four complete cycles of 24 hours at 0° F. and 24 hours at 140° F. Again, there was no apparent change in the appearance of the coatings; the coatings did not crack or peel during the low- or high-temperature testing.

Outdoor Weathering

The ultimate test for any coating of this type is its ability to stand up on prolonged outdoor exposure. Coatings were placed on outdoor exposure racks in

Table 5. Effect of C-1 Brushable Resurfacer On Light Transmission Of Weathered Fiberglass Panels.

Laminate Color*	Resurfacer Color	Light Transmission, %**		
		Weathered	After Cleaning	After Coating
Green	—	21	24	—
"	White	22	24	25
"	Green	22	23	22
"	Clear	23	24	31

* Base laminate—corrugated, smooth sides.
**Measured in accordance with ASTM D1494-57T.

Table 6. Effect of C-1 Brushable Resurfacer On Heat Transmission Of Weathered Fiberglass Panels.

Laminate Color*	Resurfacer Color	Radiant Heat Transmission, %**		
		Original	After Cleaning	After Coating
Green	—	21	22	—
"	White	20	22	25
"	Green	22	23	25
"	Clear	21	21	29

* Base laminate—corrugated; smooth both sides.
**Measured with a G-E Radiation Meter, Type DW-60.

San Diego, Calif., facing south at a 45° angle. After approximately one-year exposure, the coatings showed no change in appearance as evidenced by gloss loss and change in color. Outdoor exposure tests are continuing, and it is expected that the coatings should have a life of 3-5 years without an appreciable loss of gloss or color.

Light and Heat Transmission

Since these coatings are pigmented, it is expected that they would reduce the light and heat transmissions of the base fiberglass panel. This may or may not be the case, depending upon the condition of the base panel surface. Table 4 gives the reduction in light transmission and radiant heat transmission of a clear, flat, 1/16-inch thick, new fiberglass-reinforced polyester panel (flat and smooth on both sides) coated with the brushable resurfacer. The changes in transmission shown in these tables will not be numerically the same for all cases, since variables such as original transmission and thickness of the coating will affect the results. The data does show the range of reduction which may be experienced.

On old or weathered panels, there is an additional variable in that the weathered panel may be roughened, dull, and show glass fibers on the surface. For these panels, the transmission values (for both light and heat) may be reduced or increased from the actual weathered-panel values. The application of the Brushable Resurfacer will result in the coating of many of the surface fibers to provide a smoother, glossier surface. As a result, the final transmission values may be higher than the values for the weathered, uncoated panels.

A few typical values for light and heat transmission for weathered panels are given in Tables 5 and 6. It should be appreciated that the many variables affecting surface condition make it impractical to state that the transmission values will be either higher or lower for any particular case of application. For these tests, the Resurfacer was applied to corrugated panels having approximately six years of exposure. The panels were cleaned with detergent prior to coating.

Acknowledgement

The authors wish to express their appreciation to the Alsynite Co. of America for supplying the necessary translucent fiberglass panels for these tests.

—The End

A New Look at Dry-Color Dispersion

(*Continued from page 31*)

Bibliography

(1). "Latest Advances in Dry Coloring", S. E. Glick, **Modern Plastics**, 28, 6, 79 (Feb. 1951).
(2). "Dry Coloring Proves its Case", F. Duncan, **Ibid.**, 29, 2, 96 (Oct. 1951).
(3). "Special Purpose Injection Machine Nozzle", A. R. Morse, **Plastics Industry**, 10, 9, 18 (Sept. 1952).
(4). "Terminal Plasticizing Nozzles", A. R. Morse, **Ibid.**, 14, 6, 22 (June 1956).
(5). "A New Breaker Plate for Dry Coloring of Polyethylene", J. E. Simpson, p. 642, Technical Papers—Vol. IV, published by the Society of Plastics Engineers, Inc. (1958).
(6). "Dry Coloring Methods for Injection Molding of Polyethylene", J. A. Scott, C. J. Silas and J. V. Smith, Technical Papers, **PLASTICS TECHNOLOGY**, 4, 6, 552 (June 1958).
(7). "Molding Dry-Colored Polyethylene", C. L. Weir, **Modern Plastics**, 35, 11, 97 (July 1958).
(8). "Injection Molding of Rigid Polyethylenes", P. J. Boeke and J. N. Scott, **Western Plastics**, 5, 9, 22 (Sept. 1958).

—The End

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Physical Properties of Premix Moldings

How compression and transfer molding methods compare in their effects on physical properties of the resulting moldings.

REINFORCED plastics have filled a need for high-strength molded parts. It has long been customary to use transfer molding techniques, as well as compression molding, for conventional thermosetting compounds. Selection of the molding procedure normally has been associated with problems related to molded inserts, flash removal, and economic considerations. Since the transfer molding technique frequently provides some advantages to the molder, it has been investigated for use in conjunction with glass-polyester premix. In some instances, the premix material has been used in existing transfer molds. Frequently, the transfer-molding procedure has been considered for molding newly-designed parts that must have high-impact strength.

The question often has arisen as to whether or not the use of premix molding compounds in these molds will result in articles with the strength characteristics generally attributed to premix. Other questions have arisen regarding the use of the transfer-molding technique as related to proper sprue size, proper glass fiber length, and amount of glass to be incorporated in the premix. This article contains the results of a study that was undertaken to provide an answer to these questions, based on flexural strength and impact strength data.

Testing Program

Compounding of Specimens

Experimental compositions were made using readily-available raw materials and typical mixing equipment. The selection of resin and fillers was made on the basis of prior knowledge concerning their suitability for

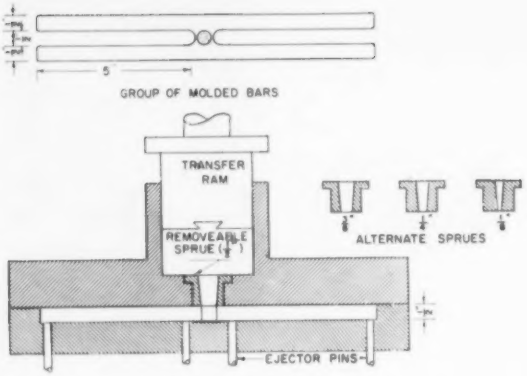


Fig. 1. Transfer mold for impact and flexural strength specimens.

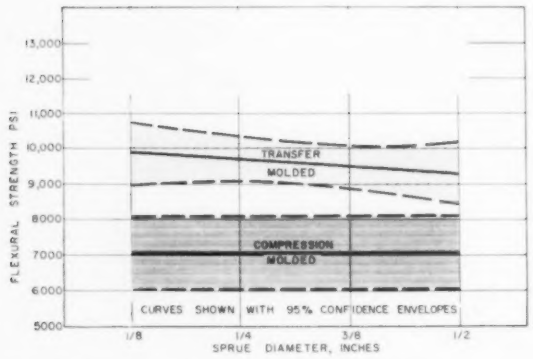


Fig. 2. Flexural strength of 5% glass-polyester premix compounds molded by transfer and compression methods as a function of sprue diameter.

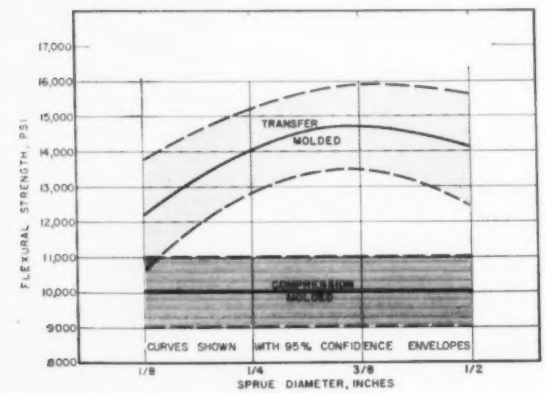


Fig. 3. Flexural strength of 15% glass-polyester premix compounds molded by transfer and compression methods as a function of sprue diameter.

making readily moldable compounds.* The experimental compositions were made at the following three typical glass content levels:

	Glass Content, Wt. %
Low Glass	5
Medium Glass	15
High Glass	27

These compositions were made by adding the components to the mixer in the following sequence:

Material	Mixing Time, Min.
1. Resin	0
2. Catalyst	5
3. Filler	15
4. Glass	20

After mixing, the compounds were placed in covered metal containers that were stored at 50° F. until all test bars had been molded (approximately one week in time).

Each of the above compositions was made using three different glass fiber lengths; namely, ¼-, ½-, and one-inch. For each specific glass content, the general appearance of the compositions made with different fiber lengths was the same. The high glass content (27%) compositions were transitional in appearance and handling qualities between the putty-type and straw-type materials.

Molding and Testing

Test bars were molded using the compression molding and transfer techniques. The compression-molded test bars were made using a mold as described in ASTM D647-54T. Construction of this mold and dimensions of the molded test specimens are conventional. Test bars were molded by placing a weighed amount of molding compound, which had been formed into an elongated flat preform, into the mold cavity. The mold was closed within five seconds under sufficient pressure to compress the material into a bar of the desired dimensions.

Test bars were made by transfer molding using a specially-constructed mold (see Figure 1). Cavities were placed in the form of the letter "H" with the transfer sprue at the center of the group. A series of removable sprues were made having nominal diameters of ⅛-, ¼-, ⅜-, and ½-inch. The mold was mounted in a 50-ton top ram transfer press. A top ram force of 11 tons was applied to a 2⅞-inch diameter ram which was equivalent to a maximum molding pressure of 3,380 psi. All of the transfer molded test bars were made under these conditions.

The Izod impact strength of compression and transfer molded materials was determined in accord with ASTM D-256-54T. Six determinations were made on each composition that was evaluated. Flexural strength was determined in accord with ASTM D-790-49T. Six determinations of flexural strength also were made on each composition.

*"Polyester-Glass Molding Compounds," H. R. Sheppard, Modern Plastics, 31, 8, 121 (April 1954).

A large number of test bars were molded using both transfer and compression techniques so that at least twice as many bars were available for testing as were necessary. The bars that were tested were selected at random from all of the available bars. Test results were used as the sole basis for conclusions drawn from this study.

Test Results

The transfer molding procedure used in this work was selected as conforming to the normally-accepted concept. It is recognized that commercial practice sometimes dictates that modifications of this procedure be used in order to make the molding of a specific part practical. A combination of transfer and compression molding was used in which glass-polyester preforms were placed in the cavities of the mold, as well as in the transfer pot. Parts that were produced in this manner had some of the desirable physical properties resulting from compression molding, as well as some of the molding advantages from the transfer procedure. Results of this test program will be considered in this section, and the reader might think back to this molding example in attempting to appraise realistically the significance of these results.

Variability

Test results obtained for both impact and flexural strengths displayed a wide spread from the mean for all compositions and all molding procedures. It was desirable, therefore, to treat some of the data statistically for presentation so that the reader would have a correct understanding of the confidence to be placed in the values presented. All of the flexural strength data were handled in this manner.

The least-squares-regression-analysis technique# was used to establish the best line for the values obtained, as well as the 95% confidence envelopes about that line. This technique was not used in presenting the impact strength data, although wide variability also was experienced here.

#Ostle, Bernard, "Statistics in Research," Iowa State College Press, Ames, Iowa (1954).

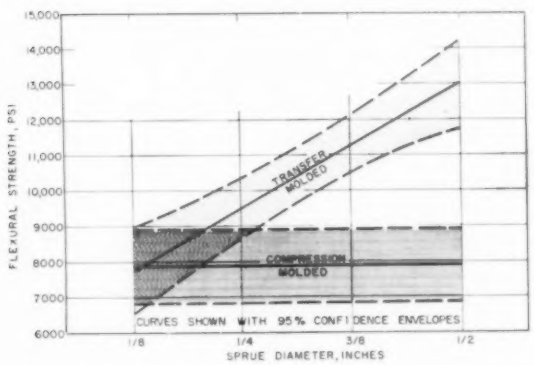


Fig. 4. Flexural strengths of 27% glass-polyester premix compounds molded by transfer and compression methods as a function of sprue diameter.

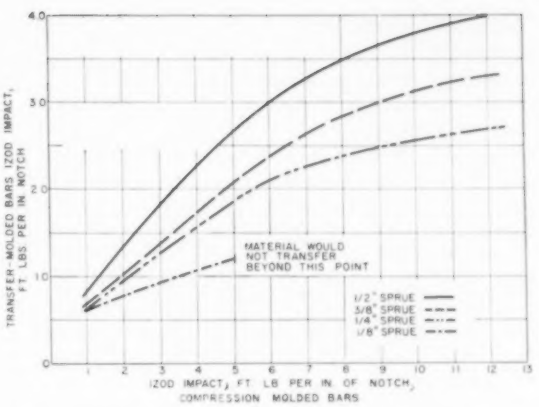

TRANSFER MOLDED BARS IZOD IMPACT, FT LBS PER IN NOTCH
4.0
3.0
2.0
1.0
0
MATERIAL WOULD NOT TRANSFER BEYOND THIS POINT
1/2" SPRUE
3/8" SPRUE
1/4" SPRUE
1/8" SPRUE
1 2 3 4 5 6 7 8 9 10 11 12 13
IZOD IMPACT, FT LB PER IN. OF NOTCH, COMPRESSION MOLDED BARS

Fig. 5. Reduction in impact strengths of glass-polyester premix compounds by transfer and compression molding.

Glass Fiber Length

The effect of glass fiber length on properties of molded parts was studied thoroughly as a function of transfer and compression molding. Small variations as a function of fiber length were observed. It was found, however, that the changes in physical properties resulting from transfer molding, in comparison with compression molding, were so great that the effects of glass fiber length were obscured. For this reason, data obtained on all fiber lengths were combined and used to arrive at the flexural and impact strength correlations presented.

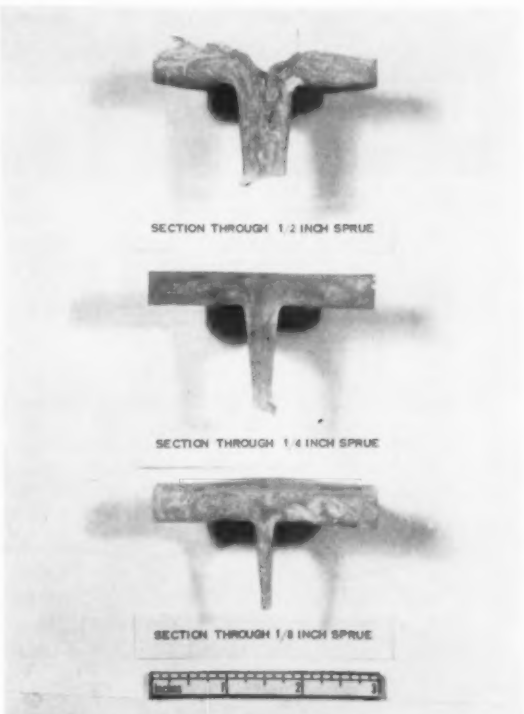


Fig. 6. Cross-sectional views of fiber orientation in various sprue diameters for glass-polyester premix moldings.

Flexural Strength

Flexural strengths of the molded parts were correlated with the size of the sprues used in transfer molding. These results are shown (see Figures 2, 3, and 4) in comparison with the flexural strengths of the compression-molded specimens. It can be seen readily that the flexural strength of the transfer-molded material, in general, is greater than that of the compression-molded material. However, there are important differences in this comparison as a function of glass fiber content.

The flexural strength of 5% glass in polyester premix did not vary appreciably as a function of the sprue size (see Figure 2). When 15% glass was used, the flexural strength was a curvilinear function of the sprue size, tending to decrease as the sprue size decreased (see Figure 3). There was a marked decrease in flexural strength of the 27% glass content material as a function of the sprue size (see Figure 4).

It is evident that transfer molding will provide higher flexural strength than compression molding, and that large sprues are desirable to maximize the improvement in flexural strength that accompanies transfer molding.

Impact Strength

Results of the evaluation of impact strength as a function of molding procedure, sprue size, and glass fiber content showed conclusively that large reductions in impact strength result from transfer molding (see Figure 5). Although the use of large sprues tended to minimize the reduction in impact strength resulting from transfer molding, the reduction, at best, was very great.

Since glass-polyester premix materials frequently are used to produce molded parts with high impact resistance, it is evident that transfer molding will greatly minimize the benefits anticipated from their use. It should be noted that the greatest reductions in impact strength occurred when very high-impact strength materials were used. Under conditions of this investigation, the high-impact level materials could not be transferred through the ⅛-inch diameter sprue.

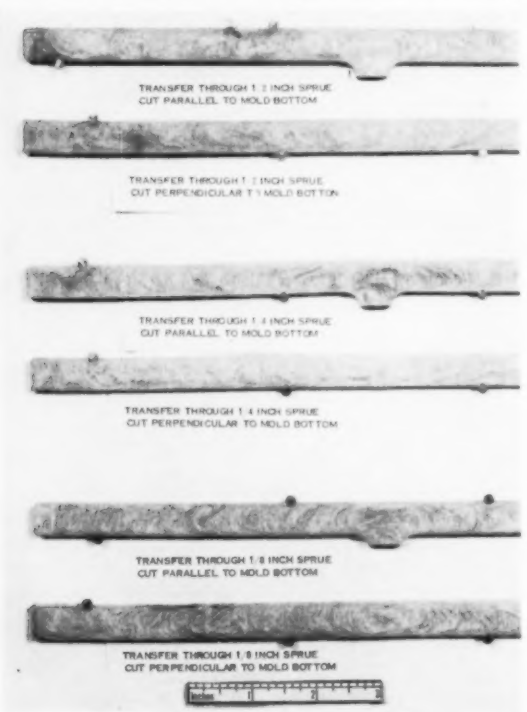

TRANSFER THROUGH 1/2 INCH SPRUE
CUT PARALLEL TO MOLD BOTTOM
TRANSFER THROUGH 1/2 INCH SPRUE
CUT PERPENDICULAR TO MOLD BOTTOM
TRANSFER THROUGH 1/4 INCH SPRUE
CUT PARALLEL TO MOLD BOTTOM
TRANSFER THROUGH 1/4 INCH SPRUE
CUT PERPENDICULAR TO MOLD BOTTOM
TRANSFER THROUGH 1/8 INCH SPRUE
CUT PARALLEL TO MOLD BOTTOM
TRANSFER THROUGH 1/8 INCH SPRUE
CUT PERPENDICULAR TO MOLD BOTTOM

Fig. 7. Sectional views through transfer-molded test bars showing fiber orientation caused by various sprue diameters.

Fiber Orientation

In an effort to understand better the reasons underlying an increase in flexural strength and a decrease in impact strength which resulted from transfer molding, a visual study of fiber orientation in the test bars was made. A series of molded bars were made in which the glass-polyester premix compound was modified by eliminating pigments so that fiber orientation could be observed.

In general, a higher degree of fiber orientation accompanied the transfer of material through small sprues. This was observed first in the cross-section of the cured premix that was removed from ½-, ¼-, and ⅛-inch sprues (see Figure 6). It is readily seen that the fiber tended to become oriented parallel with the walls of the sprue when transferred through the ⅛- and ¼-inch sprues. The fibers retained some degree of random distribution when transferred through the ½-inch sprue.

On flowing into the cavity, a very high degree of cross-orienting was observed (see Figure 7). This orientation appeared to emulate a velocity distribution curve typical of turbulent-fluid flow. Turbulence appeared to be greatest when the material was transferred through the ⅛-inch sprue, and least when the material was transferred through the ½-inch sprue. The degree of orientation was much less and random fiber distribution much greater when the material was transferred through the ½-inch sprue (see Figure 7).

Random distribution of fibers in a compression-molded bar is shown in Figure 8. In an effort to gain a better understanding of this effect, the test bars were examined carefully after they were broken. Transfer-molded Izod impact test bars which had low impact strength showed a well-defined rounded cleavage surface at failure. Izod impact test bars which had high impact strength exhibited a rough failure surface with a tendency toward the rounded cleavage surface. The break in the compression molded bars was in a plane essentially perpendicular to the axis of the test bar. Transfer-molded, glass-polyester premix test bars used for flexural strength determinations exhibited a break somewhat resembling a scarf joint failure.

It is reasonable to question the relationship of fiber orientation to increased flexural and decreased impact strength resulting from transfer molding. Since it has been observed that failure of test bars molded using the transfer-molding technique always occurred along a cleavage plane typical of transfer molding, it must be assumed that the contrasting high flexural strength and low impact strength results stem from the difference

in the test methods and, in particular, the difference in the rate of load application. The Izod impact test method has a loading rate of 11 feet per second, and the rate of loading ratio is 7200:1, while the flexural strength test method has a loading rate of 0.11 inch per minute at the same ratio.

The cleavage surface for compression-molded test bars normally was very rough, and parallel to the direction of loading. Cleavage surface for transfer-molded test bars generally was much greater in area than that exhibited by the fracture of compression-molded test bars, so that the load was distributed over a much greater area. It is believed that this resulted in higher flexural strength for the transfer-molded material. In contrast, it is believed that the well-defined cleavage surface of the transfer-molded material was more readily fractured by impact loading and provided an easy means of failure. Even though the area of fracture of compression-molded bars was less than that of transfer-molded bars, the lack of orientation undoubtedly resulted in greater resistance to notch sensitivity with the accompanying greater impact strength.

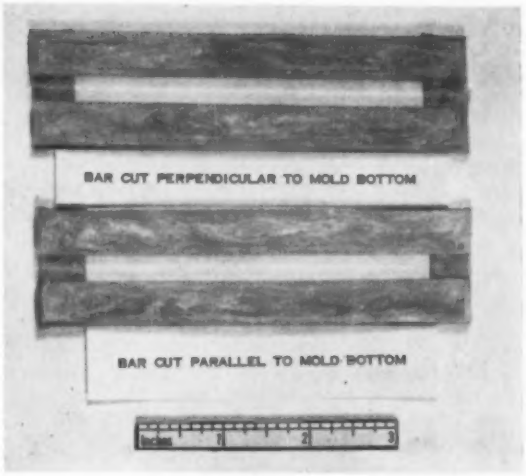


Fig. 8. Sectional views through compression-molded test bars showing fiber orientation caused by various sprue diameters.

Conclusions

The transfer molding technique generally has been found unsatisfactory when used in conjunction with polyester-glass premix materials. The object of this work was to obtain a better understanding of the suitability of transfer molding as a technique for use with high impact-strength premix.

Although it was found that large sprue sizes should be used to minimize reductions in impact strength due to transfer molding, it also was found that large reductions occurred even under the best conditions used. In general, flexural strength of the transfer-molded materials was found to be superior to that of the compression molded composition.

It was found that the length of the glass fiber in the range from ¼- to one-inch did not appreciably affect the flexural strength of the transfer-molded material. A knowledge of the nature of glass fiber orientation has provided a better understanding of the difference in properties of transfer- and compression-molded glass-polyester premix materials.

Potentials for Diversification of the Post-Thermoforming Industry
(Cont'd. from page 38)

polyethylene that were most successful in post-thermoforming a flower pot on a double-action machine, attaining uniform cross-sections at a depth of draw ratio of 1:3 in a preliminary effort. This particular item was thermo-trimmed in an integrated cycle. The same also applies to an acrylic disposable cup.

The ability to pre-stretch these materials uniformly, employing the mechanical-assist technique under rigid thermal and speed controls, goes considerably beyond the ratio mentioned above. Since 1955, I do not recollect having seen too many items of importance that were post-thermoformed from polyethylene until recently at the National Plastics Exposition in Chicago, last November, where a formed waste paper basket of linear polyethylene was on display.

Acrylics play a certain role with a view toward specific end-service requirements. Undeniably, these materials are excellent for the thermoforming of kitchen sinks, bath tubs, boats, translucent partitions, and others. Interestingly enough, European manufacturers have caught up with us in this field, and are conducting extensive research and evaluation activities.

It seems doubly unfortunate that there is little more than theoretical interest and little enthusiasm towards the unexploited areas. There are too few trained engineers and technologists who could initiate fool-proof programs towards this end, and these seem "bogged down" in other, more-sterile activities. In addition to the pure acrylics, acrylic-styrenes also offer potentials that certainly should be investigated.

The outlook for 1959 and 1960 favors quality which, in turn, should lead to new applications. In the past, many an otherwise well-aimed research program's failure resulted from the out-moded habit of giving predominance to volume output, rather than to the realization and/or materialization of fertile ideas.

There should be a proper balance between the quantitative and the qualitative aspects of such a program. Guesswork, as such, at this stage of development can prove costly. Trial-and-error probes can be used as a means towards establishing this proper balance. In addition, more time and effort should be spent on ideas and the broadening of technological skills. These seem more important to me than efforts at market saturation with inferior products. Parenthetically, may I point out that well-planned speculations entail a high degree of up-to-the-minute market research, as well as extreme sensitivity to potential new developments.

In conclusion: Why do so many manufacturers try the same application?

—THE END

PLASTICS TECHNOLOGY

EXPLORING FABRICATION TECHNIQUES

By L. J. ZUKOR, *Engineering Editor*

Wire and Cable Covering* . . .

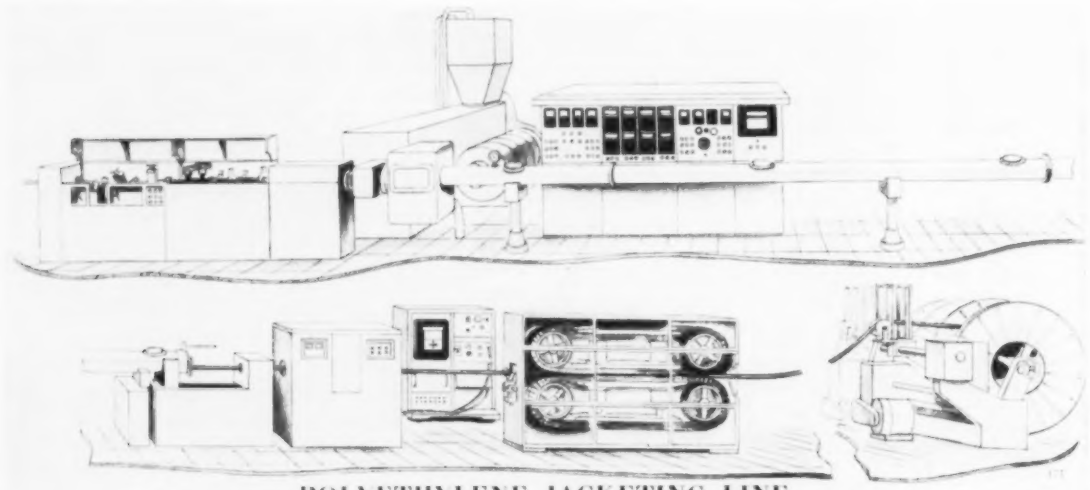
. . . Applications in which polyethylene is used in varying degrees as the insulating material, are rapidly increasing—particularly in the telecommunication field. For this use, the voltages run the gamut from microvolts to many thousands of volts with currents of a few microamperes to hundreds of amperes. Here, polyethylene with its combined mechanical, chemical, and electrical characteristics is eminently suitable. Irradiation (see our March issue, page 52) and high-density polyethylene have further extended the use of this material in wire covering. Most applications for cable require the insulation to be in solid continuous form and, to accomplish this, it is usual to use the extrusion method. In other instances polyethylene has also been used in the form of tape and as solid nodules.

Another point of interest is that polyethylene, like many other plastic materials, has been foamed around a wire core. The cellular structure is formed when an additive in the plastic decomposes in the presence of heat and liberates a gas. This, in effect, improves the dielectric qualities of the material. Because of its rheological behavior, excellent dielectric properties, and chemical inertness, polyethylene is now replacing many of the other thermoplastics and elastomeric compounds in wire insulation.

Prior to World War II, the accepted cable protective covering was lead. This metal with the peculiar characteristic of "dead fall" has all the other qualities needed to satisfy the cable manufacturing process—it is impervious to moisture, resistant to chemical attack, remains malleable after severe bending and working, offers low resistance to the passage of an electric current, and is capable of being formed around a core by extrusion. The simple expedient of adding arsenic or antimony in small amounts makes a slightly harder alloy and, at the same time, helps protect the cable from attack by rodents. Last, but not least, lead can be repaired and spliced easily. All this made it a natural for its intended service. If lead has any drawback, it would be only its weight. However, in the last years of World War II and in the years immediately following, lead was in short supply. This gave impetus to the use of other materials. The thermoplastic resins were a first choice primarily because of their ease in handling.

During this period, the Bell Telephone Laboratories,

*This is the first in a series of articles that will appear on thermoplastic materials now in volume use for Wire and Cable coverings.



POLYETHYLENE JACKETING LINE

Photo courtesy: Western Electric Co.

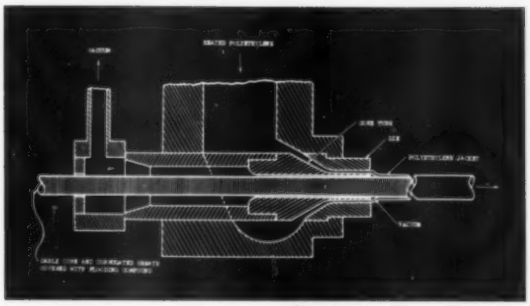


Photo courtesy: Western Electric Co.

Photo courtesy: Western Electric Co.

in conjunction with the Western Electric Co., developed a replacement cable called Alpeth. This cable used the existing core material which consisted of individual wires insulated with expanded pulp, over which was placed a dual contra-wrap of paper for increased core-to-sheath insulating strength. In the new cable, aluminum is used to obtain sheath conductivity. For the larger diameter cables, the aluminum sheath is corrugated laterally to allow the cable to bend without damage. An asphalt base cement is applied over the aluminum. The cement acts to bond the aluminum to the extruded polyethylene outer covering.

Continued research and development by Western Electric has brought forth many variations, among these is the Stalpeth cable. This is used where maximum protection is required and consists of an added barrier of corrugated tin-coated steel placed over the aluminum. In this construction, the overlapping seam of the steel is soldered together by induction heating. Another variation is known as P.A.S.P., in which a polyethylene cover is extruded directly over the core prior to the placement of metal coverings. The present Alpeth construction consists of polyethylene insulated conductors wrapped with Mylar-faced rubber tape and sheathed with aluminum and polyethylene. The use of polyethylene directly covering a conductor in lieu of expanded pulp provides better moisture protection.

In the manufacturing process, thickness of the polyethylene jacket depends on the ratio of extruder screw speed to the speed of the tractor capstan (draw-off mechanism). Interaction of these signals varies the capstan speed to maintain a constant ratio between extruder output volume and linear speed. By this mechanism, when the extruder speed is changed, constant wall thickness of the extrudate is maintained automatically. The concentricity of the jacket depends upon the relative position of core tube and die and upon temperature and pressure distribution occurring in the annular space between core tube and die. Since the extrusion process is continuous, the manufacturing line is equipped with accumulators for rubber tape and aluminum foil. These allow for the brief stopping time necessary to splice each of them. Dual cable core supply and take-up positions are also provided to avoid stopping the extruder. A recording capacitance bridge, graduated in thousandths of inches of polyethylene jacket, records the thickness at octants around the cable. This chart is also used by the operator to check concentricity and roundness of core. The finished cable is then reeled directly upon shipping reels at the end of the production line. Before shipment, the cable is tested for core-to-sheath breakdown, conductor resistance, shorts, crosses and opens, dielectric strength, mutual capacitance, and capacitance unbalance. Some of these items are checked on a statistical sampling basis only.

Other pertinent facts of interest are: aluminum strip thickness is 0.008-inch; the steel is 0.007-inch and is tin plated; and the Mylar tape is 0.001-inch thick and bonded to the elastomeric material.

●

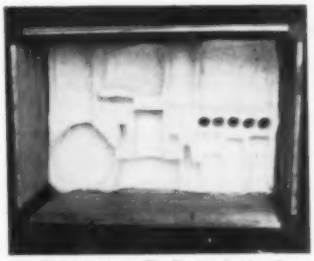
Polyurethane Foams . . .

. . . both rigid and flexible, have improved in quality and now find wide-spread use in commercial applications. The latest automobile models are equipped with dash-board crash protectors made of vinyl outer covering, into which urethane foam has been introduced. In the fabrication process, the vinyl outer covering is usually produced on vacuum-forming equipment. The

(*Continued on page 50*)

Simple wood mold form.

Photo courtesy: The Dayton Rubber Co.



Urethane container in which components of a solid fuel rocket engine are shipped.

Photo courtesy: The Dayton Rubber Co.

High-Density Cellular Vinyl by Direct Extrusion
(*Cont'd. from page 37*)

fillers at all volume concentrations of filler added (see Figure 7). Five percent (volume concentration) more gas filler can be used than either of the solid fillers when formulating to a specific 100% modulus value.

Loss of elongation in the range of loading studied is not too severe with any of the fillers (see Figure 8). Here, the use of compensating plasticizer has resulted in elongation values with calcium carbonate that are higher than the original unloaded values. Nitrogen gas may be regarded as of medium effect with respect to percent retention of elongation during loading.

Effect of Loading on Cost

In most cases, the major justification for adding a filler is to lower the raw material cost of a product with a minimum loss of physical properties. The compound raw material costs have been calculated in terms of dollars per cubic foot at various volume concentrations of loading. This calculation shows that while nitrogen gas produces a slightly lower cost system at some loading levels, all three loading agents are equivalent, in general, and choice must be based on physical property considerations.

Since physical properties then become the main criteria for choice, the volume cost also has been calculated for this same data on the basis of tensile strength. Here, nitrogen gas clearly is superior to the other two fillers in the raw material cost in dollars per cubic foot necessary to attain a specific tensile strength in the end-product. If 100% modulus had been chosen as the criterion, gas would have been even more effective than either of the solid fillers (see Figure 7).

Applications

Gas will be chosen as the filler in a compound not only on the basis of lower cost than the normal solid fillers, but also for the unusual properties imparted to the finished product by the cellular character of the filler. Among these properties may be included low density (buoyancy), minimum loss of tensile strength and modulus, resiliency, compressibility, thermal insulation, and softer compounds with lower total plasticizer content. Commercial use of these characteristics may best be considered in terms of specific products.

Spline and glazing normally are extruded at a constant hardness level. The major advantages would be compressibility and resiliency which would permit a stiff compound to be inserted into a channel without shearing off the edges. These advantages also may permit the use of one size of window glazing for several thicknesses of glass.

Welting and weather stripping compounds are resilient, abrasion resistant, and will vary in hardness from soft to firm. Use of gas as a filler will permit the incorporation of less plasticizer and, thereby, limit the staining and migration problem while maintaining the softness and resilience of the product. The increased thermal insulation properties will make a more desirable weather stripping product.

High modulus and compressibility are desirable attributes in a gasket compound to insure good sealing. Resiliency may be desirable in some applications, especially where damping of sound or vibrations is desired.

Extruded vinyl is not now used for cable separators and fillers, but is particularly well adapted to this use by the unique properties imparted with gas filling. Cables normally are filled with jute, cotton, fibrous glass, or paper. In this use, low density is of great concern and, in fact, buoyancy may be a very desirable attribute in design of floating cables. Resiliency and compressibility are required for definition and retention of shape in the completed cable. The low volume-cost of these gas-filled extrusions, when combined with the fire resistance, improved electrical properties, and lack of wicking when exposed to water (as in a cable break), make them desirable filling and separating materials.

—THE END

Conclusions

It is shown that gas can be incorporated into an extruded vinyl compound by means of a direct-extrusion method using conventional equipment.

The gas so incorporated can be considered a filler, as is clay or calcium carbonate.

The unique properties and economic advantages imparted to a compound by gas make it a more desirable loading agent than solid fillers for many applications.

Polyurethane Foams
(*Cont'd. from page 49*)

preformed shell is placed together or attached to the metal hardware used to hold the assembly in place in the automobile. This sub-assembly is then filled with a measured amount of the foaming mixture which expands, sets in position, and permanently cements itself to the vinyl.

The nature of this material lends itself to the preparation of protective shipping containers. The Dayton Rubber Company describes a method for preparing a compartmented container by using a simple and inexpensive jig, that is a wood dummy in the size and shape of each needed cavity. The separate dummies are then mounted on a board for best space utilization. When finished, the mold is coated with a thin film of release agent. The urethane mixture is introduced through a hole in the inverted mold. Before setting, the foam completely fills the cavity, exactly reproducing each detail of the mold. The wood form is then removed and can be used over again.

Another innovation is a truly unbreakable "Thermos" bottle. The fabrication steps are, as follows: inner and outer envelopes of polyolefin material are blow molded, the two parts are assembled, and the space between

(*Continued on page 54*)

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Edited by:
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Atlas Machine & Tool Corp.
East Rutherford, New Jersey

Machinery Maintenance

Repairs of Damaged Molds and Mold Alterations

Atomic-hydrogen arc welding differs from metallic arc welding in that the arc is formed between two electrodes, rather than between one electrode and the work. The welding heat is generated primarily by the recombination of atomic-hydrogen produced by dissociating hydrogen in its normal molecular state through the agency of an electric arc—hence the name "atomic-hydrogen." The arc is completely surrounded by an atmosphere of hydrogen which performs the double function of transferring heat from the arc to the work, and shielding the molten metal from oxidation by the air. The arc provides a medium for heat transfer and aids in breaking down the hydrogen into its atomic form. The heat transfer also results in a recombination of the atomic hydrogen when the heat is liberated at the surface of the metal being welded.

REPAIRING MOLDS AND TOOLS. Atomic-hydrogen arc welding has proved itself to be highly valuable in the repair of permanent molds and similar equipment, as well as for alteration of existing molds to accommodate engineering or design changes, and to rectify mistakes of machining. Advantages of the atomic-hydrogen arc-welding process for this class of work are as follows:

(1). Metal of the same analysis as the part being welded can be deposited. For this purpose, the filler rod used in making the deposit should be of the same analysis as the part being welded, except that it should contain about one-third more carbon to compensate for the loss of this element during welding. No appreciable changes take place in other elements. Ordinarily flux is not required.

(2). The heat-treating properties of the deposited metal are the same as those of the unit, a feature that insures uniform composition for reworking and thoroughly reliable service from the repaired unit.

(*Continued on page 54*)

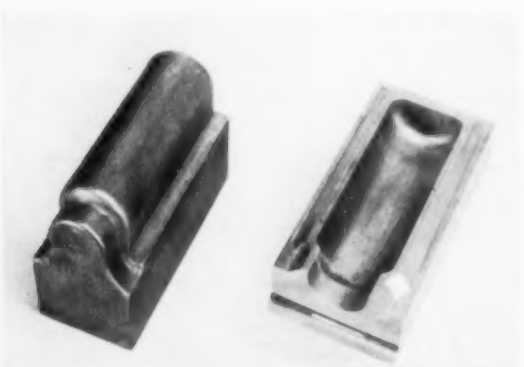

Fig. 1. Repaired beryllium copper cavity (right). Photo courtesy: General Mold Casting Corp.)

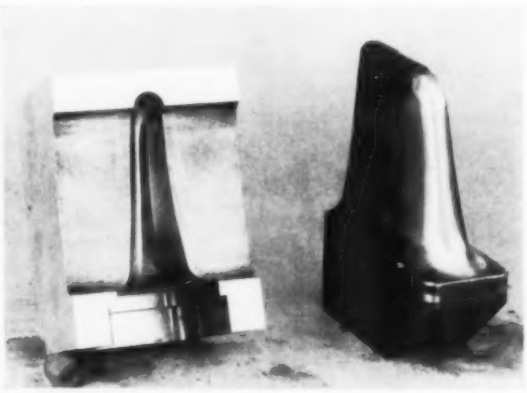

Fig. 2. Repaired cast tool steel cavity (left) and hob (right). (Photo courtesy: Newark Die Hobbing & Casting Co.)

Edited by:
E. BOWMAN STRATTON, *Vice-Pres.*
Auto-Vac Div.
National Tool Co.
Bridgeport, Conn.

Blow Molding

The Enlarging Blow Molding Field

The entire plastic industry and, in fact, the consuming public, has been aware for some years of the presence of plastic bottles, particularly the "squeeze" bottle. Until recently, however, all of these items have been produced by a handful of molders who have developed their own techniques and equipment. In recent months, we have seen the beginning of an enlargement in this field of application and the number of firms producing items by this process—blow molding.

A year ago, there was as yet no published information available, nor was there equipment generally available to interested parties. By comparison, we have seen recently several excellent articles printed in the trade journals or presented at the well-attended session on blow molding at the recent SPE ANTEC in New York. These articles have been very well received by an industry hungry for information on a process in which they can see a great future.

Blow molding machines were publicly displayed for the first time at the National Plastics Exposition in Chicago last November. Since then, we, among others, have announced our entrance into this field. Today, there are for sale in this country four domestically-produced machines and four foreign-built machines. Here again, industry has clamored for full information regarding these pieces of equipment, even before some of them could begin their actual production. All of this shows a remarkable interest in a field which has been extremely secretive until recently.

We have tried to analyze just who these people are who are expressing an interest in this process. It would appear that they fall into several distinct categories:

(1). Custom molders who see this process as a method of further diversification and added profit for their organization.

(2). Glass bottle manufacturers and distributors who see plastic encroaching on their present market. Their interest is the maintenance of their present distribution and their status with established customers.

(3). Metal container producers whose interest parallels that of the glass bottle manufacturers.

(4). End-product users who may or may not have made their own containers or other items previously. This is a large field and includes firms who heretofore could not afford the expensive equipment to produce glass bottles, but can afford the lesser expenditure of plastic blow-molding equipment. It also includes firms producing items such as toys, who see an inexpensive new process for forming hollow objects which they want to market.

Also assisting this wide current expansion are new materials which lend themselves readily to this process and which offer improved properties over other available material. Immediately apparent is the introduction of linear polyethylene which is ideal for thin-wall bottles to be used not as "squeeze" bottles, but as carriers only. These containers currently are being test-marketed by many firms. The expected increase in production of this material, which current prognostications show, can be traced directly to expectations in the production of these carrier bottles alone. In 1957, approximately 15-million pounds of polyethylene went into blown bottles. It is expected that this figure will increase in a few years to 200-300 million lbs., depending on whose figures you check. These predictions do not include, you will note, any items other than bottles, nor any material other than polyethylene.

Some specific applications already have proved ideal for some of the other new materials, including poly-

(*Continued on page 54*)

Machinery Maintenance

(*Cont'd. from page 52*)

Hard-surfacing electrodes, sometimes used in die repair, have caused trouble when it was necessary to anneal the mold for reworking since the deposit was not effected by the annealing temperature.

(3). Atomic hydrogen produces an unusually smooth, ductile deposit free from any pinholes or impurities such as oxides and nitrides. The weld is clean and free from scale, and the work is not pitted by weld spatter. Undercutting is easily avoided.

(4). Deposition can easily be varied from the thinnest surfacing to a heavy deposit. Feather edges can be built up without putting on excess metal. Definite savings are made by depositing exactly the amount of metal required, thus reducing machining costs.

GENERAL WELDING PROCEDURES. While atomic-hydrogen arc welding is decidedly different from metallic arc welding, its operation is as simple as the metallic arc welding method. The flow of hydrogen is controlled automatically, and the welding apparatus is equipped with an indicator that registers the degree of heat being produced by the unit. The electrodes used should be large enough to accommodate the current required without an excessive consumption of the tungsten electrode itself.

In the atomic-hydrogen welding process, counteracting warpage is a problem due to the area affected by the heat of the arc. The operator can learn to maneuver the electrode holder skillfully so as to minimize this effect.

CHANGES AND CORRECTIONS. Many times when a mold is being machined, last-minute engineering changes are made requiring an alteration in the shape. If the change involves removal of more metal, the problem is relatively simple. However, when the change involves the addition of metal that has been machined away previously, it may mean scrapping all the work which has been done and starting over—unless atomic-hydrogen arc welding equipment is available to use in adding the needed metal. Again, it often is found that a minor change in design of the particular part being produced must be made after the mold has been in use for a short time. Although it may be in good shape otherwise, such a mold often has to be scrapped and rebuilt in order to incorporate the desired changes, unless atomic-hydrogen welding is utilized. Likewise, errors in machining can be corrected readily by this method.

The use of atomic welding should not be limited to repairs or changes in mold components, nor must it be limited to those components that normally are machined from solid stock. It can be applied successfully in other methods of mold component construction, such as hobbing, beryllium pressure casting, or steel castings. Furthermore, the welding technique very well can be considered a method and procedure of cavity or force construction. Often, mold components involve sections that are too difficult either to machine form a solid billet, hob, or cast from their basic shapes. The welding of the parent material at a strategic point can yield a section that is readily machinable to the final desired section.

Mold construction materials such as beryllium copper, casting alloys, and tool steels of all types readily are weldable with the proper application of welding technique and suitable welding materials. Examples of intricate cast items are shown in Figures 1 and 2, illustrating that even a most minute change can be applied by careful welding, and still not detract from the over-all expensive contours and shapes that already exist.

Needless to say, this processing not only requires special equipment, but also the highest skill in performance. Very few shops measure up to these requirements and, from personal experience, I can recommend PRECISION TOOL & DIE WELDING CO., Clifton, N. J., as qualified to handle any job, large or small, very successfully.

—THE END

Blow Molding

(*Cont'd. from page 53*)

propylene, polycarbonates, acetal resin, and some of the older materials such as styrene, vinyls, and nylon.

All of this activity has laid the foundation for many new ideas as yet undeveloped in the minds of product designers all across the country. What innovations they will introduce after the process is understood by our industry in general would be pure conjecture at this time. We do know that possible applications are being considered presently in all our major classifications of industry; including automotive, appliance, industrial, electrical, packaging, and toys.

Blow molding is in the same position today where injection and compression molding was 25 years ago. To what size this field eventually will grow is anyone's guess, but it is a certainty at this time that we currently are on the threshold of a tremendous expansion.

—THE END

Polyurethane Foams

(*Cont'd. from page 50*)

filled with the urethane foaming mixture. A low "K" factor makes this material suitable for insulation use and for rigid foam is 0.19.

These unique compounds of carbonic acid and urea are presently being used in the manufacture of many diverse products. The long list includes potting of electronic assemblies, in situ formation of insulation on valves and other pipe fittings, cellular sandwich structures for the aircraft and automotive industries, shock absorption material for seat cushions, and packaging of fragile materials. Recent reports have been circulated on urethane foam cements that have been used with excellent results to mend fractured bones. A study has shown that this material does not form a static joint such as occurs when two pieces of wood are cemented together. The polyurethane foam sticks first and then forms a framework into which new bone grows over and through.

—THE END

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NEWS

company moves and expansions

Metalmold Forming Co. has moved to new and larger quarters at 68 Jay St. Brooklyn 1, N. Y. Previous address for the mold-making firm was 53 Greene St., New York City. The move virtually doubles the firm's available space, and necessitated a 30% increase in personnel.

Kaye-Tex Mfg. Corp. has completed its $1½-million expansion program with three-shift operation of a new four-roll calender. Other elements of the two-year program included major staff additions, enlarging warehouse facilities, and installation of auxiliary equipment. The firm now produces vinyl film and sheeting in gages of 0.0027-0.04 inch, and in widths to 72 inches.

Allied Chemical's Plastics & Coal Chemicals division has announced completion of new phthalate ester plasticizer facilities at its Toledo, Ohio plant. The division now offers its customers a single basic source with varied plant and distributing locations.

Reichhold Chemicals, Inc. has initiated production of polyvinyl acetate and acrylic emulsions at its plant in Jacksonville, Fla. The new facilities are said to have a capacity of about 10-million pounds annually, and still other facilities at this plant site include bulk storage areas plus a tank wagon for making combination shipments.

Colton Chemical Co., a division of Air Reduction Co., has opened a new sales office and warehouse at 209-15 South Franklin St., Tampa, Fla. Sales manager S. E. Werner heads the operation, whose products include vinyl acetate emulsions, copolymers, terpolymers, and polyvinyl alcohol.

Rexall Drug Co. plans to change its name to Rexall Drug & Chemical Co. due, it was reported, to the sales gains shown by the Chemo-Plastics division. The company further states that a major portion of its future growth will be in the petrochemicals and allied chemical fields.

Gering Products, Inc. is currently offering flame-retardant polyethylene, polypropylene, and polystyrene, in addition to various grades of flame-retardant cellulosics and vinyls. The firm's expanding service also includes custom compounding for other producers of thermoplastic molding and extrusion materials

General Tire & Rubber Co. has enlarged its plastics design facilities, including both increased personnel and expanded services. A number of stylists have been added to the staff, and Jerome Reich and Wallace Michael have been named executive coordinator of styling and director of design, respectively.

Haveg Industries, Inc. has completed installation of a 2,000-ton press for use in the manufacture of rocket, missile, and space vehicle components. Plastic parts produced include blast tubes, adapters, insulation, nose cones, jet vanes, jetevators, exit cones, and other components.

American Cyanamid Co. has set up separate administrations to direct manufacturing activities at its organic chemicals plants in Marietta, O., and Willow Island, W. Va.

Chemiform Institute has broadened its facilities as a source of chemical information to include foreign information on the composition, use, and source of supply.

Taylor Fibre Co. has undertaken a capital improvements program which will involve expenditures of more than $1-million. Part of the plan calls for erection of a new warehouse for storing vulcanized fiber—complete with moisture content control. A $¼-million dryer will be installed, which will control both humidity and temperature.

Perlon Corp., Lyons, Ill., recently completed another phase in its expansion program — the installation of equipment capable of producing an added 650,000 pounds of polyurethane resins per month. Much of Perlon's production goes to the seating and refrigeration industries.

Bestwall Certain-Teed Sales Corp. has changed the address of its Twin Cities office from the Frontenac Building in Minneapolis to 1515 West Lake St., Minneapolis, Minn.

new agents and distributors

Continental-Diamond Fibre Corp. has appointed **Summers Electric Co., Inc.**, Dallas, Tex., as stocking distributors of its CDF line of vulcanized fiber, laminated plastics, and other insulating materials. Summers will make technical information available to local customers.

Koppers Co.'s plastics division has appointed **Central Ohio Paper Co.**, Columbus, O., its distributor for Durethene polyethylene film. The film is used as a protective cover for wet cement, lumber covering, vapor barrier, and industrial drop cloths.

of the Industry

Hastings Plastics, Inc. has been appointed exclusive West Coast distributor for metal fiber fillers used in plastics. Ranging in length from 1/16-3 inches and in diameters from microns to 1/32-inch, the fibers are available in copper, aluminum, steel, bronze, zinc, lead, tin, and molybdenum alloys.

changes in ownership, new companies

Bel-Art Products of Pequannock, N. J., has acquired all the assets of **E. J. Kanter Co., Inc.,** Chicago, Ill., and plans to move all its machinery and equipment to the Bel-Art plant. Included are roll leaf stamping machines which will enable the Jersey firm to open an imprinting department.

Camdale Corp. of New York has purchased controlling interest in **Commercial Fiberglas Products, Inc.,** Houston, Tex., and has transferred its home offices to that city. This move marks Camdale's entry into the plastics field since the new subsidiary has been building reinforced plastic truck and trailer bodies and chemical tanks for quite some time.

Engineered Materials is the name of a new company which will have interests in the plastics, rubber, and ceramics fields. Located at 509 Fifth Ave., New York City, the firm is essentially a consulting organization headed by Miss Alice Gitter, a well known engineer and market analyst.

Reichhold Chemicals, Inc., has purchased **Specialty Chemicals, Inc.,** Austin, Tex., which it will operate as a wholly-owned division. The new division produces accelerators for polyesters.

Libbert Plastics, Inc., is the name of a new firm located at 5331 White Settlement Road, Ft. Worth, Tex. It succeeds the old organization, Libbert Tool & Die, and is expected to be the largest custom injection molder in the Southwest.

Polycraft Bag Co., South Bend, Ind., is a new firm which will produce heavy-duty polyethylene bags for packaging industrial and agricultural products. A new plant is nearing completion, and is expected to have an initial capacity of 12-million bags annually. The bags will be printed in up to four colors, in 25- and 50-pound sizes, and in wall thicknesses of 10 mils. Intermediate and larger sizes are under consideration.

Seiberling Rubber Co.'s plastics division has named **Ac-cello Products Co.,** New York City as Eastern sales representative for its line of Seilon rigid thermoplastic sheet. Included are various types of vinyls, styrene, ABS polymer, polyethylene, and propylene.

government bids and awards

Polytechnic Institute of Brooklyn has been awarded a contract by the U. S. Navy Training Device Center, Sands Point, N. Y., to conduct research on the production of three-dimensional plastic relief maps for military use. The sum of $33,000 represents an extension of the contract and brings its total value to $92,000. Aims of the program are to speed construction time to a map per minute, to develop materials which will withstand arctic and tropical climes.

Lustro Co., Los Angeles, Calif., was awarded a contract for 167 packages of plastic sheets—SFG-915861-59.

General Services Administration, 250 Hudson St., New York 13, N. Y., opened bidding April 4 on plastic trays and dishes made in accordance with Federal Specification L-T-775 and MIL-T-11001A and Amend 1. Quantity is indefinite. IFB NY-1SL-90079.

U. S. Army Transportation Supply and Maintenance Command, Directorate of Procurement and Production, 12th and Spruce Sts., St. Louis, Mo., is asking bids on Teflon hose assemblies. FSN 4720-591-0642, 4720-348-0677, 4720-694-9906, 4720-203-7505, 4720-575-1057, 4720-624-2848. MIL-H-25579(QPL 25579-1) 16 each items, various sizes and swagged fittings. IFB TC-23-204-59-100B.

Aviation Supply Office, 700 Robbins Ave., Philadelphia 11, Pa., is asking bids on transparent acrylic sheet, heat resistant. FSN R9330-292-9813-GB90, 80 sheets. FSN R9330-580-8898-GB90, 62 sheets. FSN R9330-580-8900-KB90, 208 sheets. MIL-P-5425B (QPL) IFB-383-712-59B.
Also, plastic pumps. Hand Acr Stk Number 4220-097-4580. MIL-P-8258B (ASG) 3,000. Pre-production samples and test report required. JD-IFB-383-642-59B.

Officer in Charge General Supply Depot Bldg. 311, Naval Supply Center, Oakland, Calif., is asking bids on polyethylene sheeting per MIL-P-19336C and Amend No. 1, 50,726 pounds. IFB 228-33425-59E.

Headquarters Oklahoma City Air Material Area, Tinker Air Force Base, Okla. is asking bids on 3990-OCS-58-189 plastic trays with O/A dimensions of 32 by 24 by eight inches high with rolled lip completely around tray. Gray in color with black numbers raised 1/16-inch or affixed in a permanent method in a/w OCAMA sketch OCS-58-189A. IFB-34-601-59-345/B/PLD.

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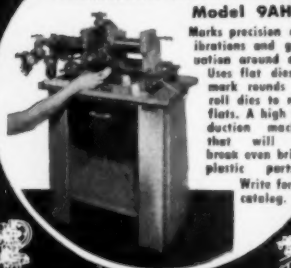

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new plants and laboratories

Air Reduction Chemical Co. officially opened its new laboratory and engineering office building on March 19. Located at Bound Brook, N. J., the $400,000 installation is adjacent to the Airco pilot plants and will serve as the center of chemical process and product development as well as research. In addition to laboratory space, the building contains a test area, engineering and general offices, and service rooms. Approximately 50-60 employes will be housed in the 10,000 square-foot structure.

Dow Chemical Co. has opened a new plant in Cleveland, O., for the manufacture of Trycite polystyrene film. Introduced last May, the film is low-cost, thin-gage material intended for flexible packaging. Dow has been supplying Trycite on an allocated basis from pilot plant facilities in Midland.

Pla-Tank division, Haveg Industries, Inc., has built a new plant in Warren, Mass., for the manufacture of large polyester-glass chemical process equipment. Initially, the unit will produce tanks up to 12 feet in diameter by 60 feet in length, plus a complete line of 25-foot lengths of corrosion-resistant duct work.

Product Designer Displaycase will open the nation's first permanent exhibition center for plastic parts, materials, and supplies on June 1 in New York City. Similar centers are being planned for the South, Midwest, and Pacific Coast. Objective of the center is to provide a clearing house for every conceivable idea and product used in the manufacture of plastic wares—a showcase of component parts.

U. S. Industrial Chemicals Co. opened its new polyethylene plant in Houston, Tex., on March 18. Initial capacity is 75 million pounds; however, plans are already underway to double this figure by the third quarter of 1960. This added to the 100-million capacity of the Tuscola plant will make U.S.I. the second largest polyethylene producer in the country.

The Houston unit is producing low density (0.915-0.924) and medium density (0.925-0.929) material. These are the polyethylenes commonly marketed as packaging film, garment bags, housewares, squeeze bottles, and wire cable coatings.

yugoslav plasticizer production

Jugovinil of Split, Yugoslavia, plans to manufacture phthalic anhydride and ethylhexyl alcohol plasticizers under license from Les Usines de Melle, Mell, Deux-Sevre, France. Formerly, the country imported almost 1,000 tons annually.

east german plastic boats

Central Institute for Welding, Halle, East Germany, has built and launched an experimental plastic sail boat which was said to have made a successful sail from the island of Rugen. The boat, 8.15 meters long, 2.25 meters wide, and 1.33 meters draught, was made with a sandwich shell including a 20mm. cellular vinyl layer between layers of glass-reinforced polyester resin. The shell was formed by hand lay-up over a wooden hull which was used for the mold. Wooden parts were bonded to the keel with cold-curing epoxy resin. A final coat of glass-reinforced polyester resin containing titanium pigment was applied to the outer surface.

DOW Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

NEW DESIGN DATA WILL ELIMINATE GUESSWORK IN PLASTICS MATERIAL SELECTION

To design a product made of plastic a design engineer must select one material from literally hundreds of different plastics formulations. When adequate performance data is not available, he often must depend on guesswork and intuition to provide an ample safety factor when writing his material specifications.

For example, the type of data readily available for most plastic materials is a single measurement of stress at a fixed time and strain (see fig. 1). This "quality control data" is helpful but usually not adequate. Going one step further, information is available on what we refer to as "screening data" which shows stress as a function of time at constant strain (see fig. 2). Yet this data offers no information on the important influence of strain.

Dow Plastics Technical Service Engineers, as a part of a continuing series of Plastiatrics studies, are conducting experiments which will provide more comprehensive data. These studies will give plastics engineers design and engineering data on stresses at several different strains and times (see fig. 3), and eventually at several temperatures.

Considerable data is already available on several Dow molding material formulations and others are being investigated. If you have an immediate problem, why not check with Dow to determine whether the application of this knowledge will answer your specific product design questions?

For more information on this important work under way at Dow, write THE DOW CHEMICAL COMPANY, Midland, Mich., Plastics Sales Department 2101DT4.

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STYRON 475
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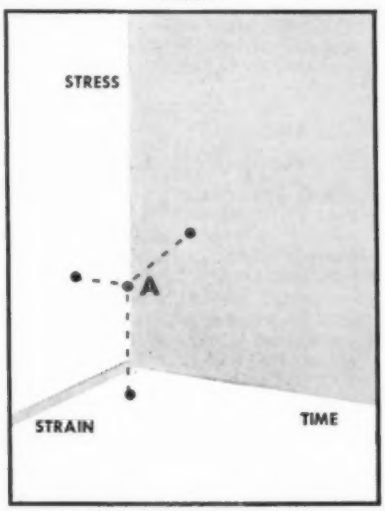
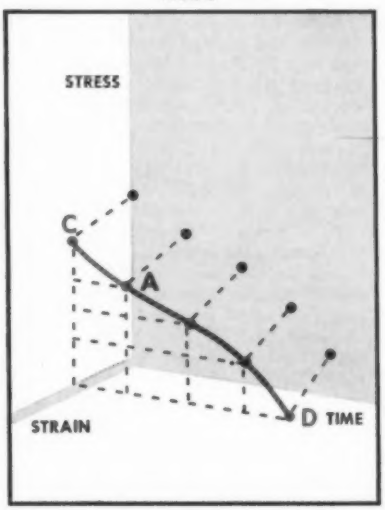
HEAT RESISTANT
STYRON 683
STYRON 700

FIGURE 1



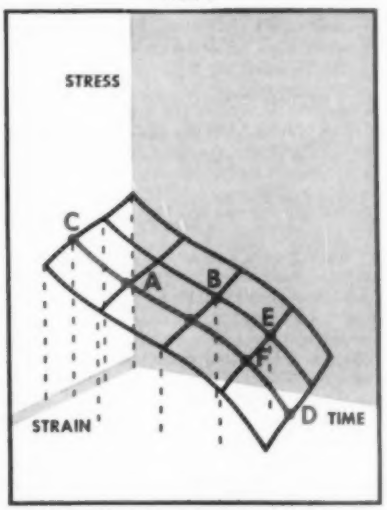
For controlling quality, a single measurement of stress (Point A) at some fixed time and strain within the elastic region could serve the purpose.

FIGURE 2



Screening products for new applications usually requires more information. Thus, stress at constant strain could be determined at various times (line C-D).

FIGURE 3



Design and engineering require more data at more conditions than described in figures 1 and 2. Stresses (Points A-B-E-F) must be determined at several different strains and times.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

News of the Societies

Alkyds in Transition

The Glycerine Producers' Association held its annual meeting January 22 at the Waldorf-Astoria Hotel, New York, N.Y. Before a group of nearly 400 representatives of the coatings industry, a panel of seven experts viewed the alkyd market as a generally healthy one, and predicted that this type resin will continue to dominate the coatings market for some years to come.

Dr. Herman J. Lanson, U.S. Vehicle and Chemical Co., spoke on the theme of the symposium, "Alkyds in Transition." He pointed out that their consumption continues to increase and today they rank as the most important synthetic coating resin, constituting about half of all the resins used in organic coatings. The versatility and usefulness of alkyd resins is due not only to the wide variation in properties which can be obtained in the alkyd forming reaction, but also because of their ability to improve the performance properties of other resins.

"Water-Thinned Resins—Where They Stand," was the topic discussed by Dr. Marvin W. Formo, Archer-Daniels-Midland Co. Although water-thinned vehicles are moving into more and more coating applications as fast as technological breakthroughs permit, more application research is required before they can be applied as uniformly and consistently as their solvent-thinned counterparts. Of the several factors which are influential in speeding development of these materials, anti-air pollution campaigns, reduced fire hazards, and simplification of formulation are considered the most important.

Dr. Edward G. Bobalek, Case Institute of Technology, spoke on "The Effect of Chemical Constitutions on Properties of Alkyd Resins." He stressed the importance of studying their chemical constitution so that new molecular structures, which would exploit one or more desirable properties peculiar to alkyd resins, could be obtained.

Monsanto Chemical Co.'s Joseph N. Butler delivered a paper entitled, "Amino Alkyds—Their Future Depends On You." He recommended that up-grading alkyd resins with urea or melamine would be another means of assuring their leading place in the coatings field. Use of amino resins should facilitate formulation of water-based alkyds, thus providing an almost limitless growth potential.

T. F. Mika, Shell Development Corp., discussed "Epoxy-Alkyd Modifications." He presented data showing the advantages of co-reacting epoxy resins with alkyds. Such coatings have higher stress-strain properties, and even after rigorous baking tests exhibit superior resistance to detergents and solvents.

"Trimellitic Anhydride, A New Alkyd Raw Material," was discussed by Dr. James Eiszner, Amoco Chemicals Corp. Coatings formulated with this acid have a shorter drying time as well as a hardness which is superior to conventional alkyds of equivalent oil-lengths.

Dr. J. S. Long, Paint Research Institute, reviewed "Research Needs That Lie Ahead," outlining the path which formulators must follow to maintain the continued domination of alkyds in the coating market. He suggested that the industry follow the prevailing trend to automation to gain further insight on the relationship between chemical composition and physical properties. By programming mathematical equations to digital computors, variables between composition and properties can be established accurately and quickly. This approach to the formulators problems will direct research operations according to preselected plans and will be an invaluable guide for many years to come.

SPE New York Section

Nearly 200 members and guests gathered February 18 at the Governor Clinton Hotel to attend New York section's first 1959 meeting. Section president, Herbert Weber, announced that since ANTEC, New York has acquired 75 new members bringing total membership to 775. Following other business announcements, he awarded the Section's traditional gavel to past-president George Leaf, for his work during 1958.

Soren Graae, Blow-O-Matic Corp., addressed the general meeting on "Blow Molding of Plastics With Blow-O-Matic Equipment." This equipment is used in conjunction with any standard extruder equipped with a crosshead for downward, vertical extrusion of a tube. As the tube is extruded, the mold halves close around it. A fast, air-operated knife cuts the extrusion at the crosshead orifice, and the tube is blown to shape by air pressure. When the mold opens, the part is ejected by an air blast and the unit is ready to receive another section of the tube. The entire principle is based on continuous extrusion, and the blow molder will dry-cycle 1,100 times per hour. While this speed can be obtained on small items, larger ones require slower cycles.

"Printing and Decorating of Polyethylene Objects," was discussed by Michael A. Spina, Interchemical Corp. After extrusion, the surface of a polyethylene object must be modified so that it will receive printing inks. The ideal situation would be to treat only the first molecular layer, but since this is not practical, the goal is to penetrate the surface as little as possible. Four principal methods of treatment were discussed. These include: chlorination, differential heat treatment, oxidation, and electronic treatment.

The VIPAC meeting drew about 90 members. J. L. Hutson, General Tire & Rubber Co., talked on "Characterization of Vinyl Resins by Viscosity." The most meaningful method of expressing molecular weight of vinyl resins is in terms of its intrinsic viscosity which, at General Tire, is measured in cyclohexanone at 25° C. Mr. Hutson defined the relationship of the various molecular weight resins to the ultimate resin properties. He pointed out also the importance of selection and control of processing temperatures to be used with each viscosity in order to obtain the maximum processing advantage.

Kentile Inc.'s Robert Braddicks, Jr., discussed "Improved Classification of Vinyls." The current practice of classifying vinyl resins through solution viscosities requires considerable improvement in order to provide maximum service to the vinyl processor. Mr. Braddicks discussed the required improvements as follows: standardization of methods throughout the resin industry; and inclusion of molten flow data for these materials at or near processing temperatures.

The Thermoformers sub-group was addressed by W. P. Gideon, Eastman Chemical Products, Inc., whose talk was entitled "Outdoor Butyrate Formulations Prove Their Weatherability." Ultra-violet radiation, which causes chain breakdown of cellulose molecules, is the major degrading factor in butyrates when used outdoors. Standard formulations have an outdoor service life of 2-2½ years; but Eastman's Formula 460 and its derivatives, which incorporate a screening agent to filter out ultra-violet rays, have been found to stand up well after five years. Tests were carried out at a weathering station at Phoenix, Ariz. which, because of its high altitude and nearly continuous sunny weather, receives about twice as much ultra-violet radiation as any other spot in the U.S. Samples were tilted at a 45° angle facing south. Both color slides and actual specimens were shown to augment the discussion.

SPE North Indiana RETEC

A symposium on "Encapsulation, Printed Circuits, and Fluidized Bed Process," is being featured May 22 at SPE Northern Indiana section's RETEC. Cosponsored by the Professional Activities Group on Plastics in Electrical Insulation, the meeting will take place at the Van Orman Hotel, Fort Wayne, Ind. Advance registration can be made through F. C. Avila, General Electric Co., Laboratory, 1635 Broadway, Fort Wayne, Ind. Papers to be delivered are as follows:

Session I—Embedment and Encapsulation in the Electrical Industry.

9:15 AM

"A Quantitative Cracking Tendency Test for Casting Resin Compositions," R. G. Black, Westinghouse Electric Corp.

9:45 AM

"Epoxy Molding Compounds," William T. Yost, Booty Resineers Div.,

American-Manetta Co.

10:30 AM
"Use of Fillers for Producing Special Properties in Plastics," Jerome Formo and Robert Isleifson, Minneapolis-Honeywell Regulator Co.

11:00 AM
"Mold Design and Filling Techniques for Casting and Potting Resin Systems," August L. Kraft, Automatic Process Control Co.

11:30 AM
"Epoxy Resins for the Encapsulation of Electronic Components," Arthur F. Ringwood, General Electric Co.

Session II—Printed Circuits in the Electrical Industry.

9:15 AM
"Flow Solder Techniques," Paul J. Budd, Electrovert Co.

9:45 AM
"Applique Wiring," Lewis Schlabach, Bell Telephone Co.

10:30 AM
"Printed Circuit Processing," George Johnson, Photocircuits Corp.

11:00 AM
"Peel Strength Measurement of Copper Clad Laminates," Charles Keppel, Motorola Inc.

11:30 AM
"Quantitative Evaluation of Thru-Hole Plating Techniques," John E. Riley, Melpar, Inc.

Session III—Forum on Fluidized Bed Process in the Plastics Industry.

2:00-5:00 PM
"Present Commercial Status of Fluidized-Bed Coatings in the U.S. and Europe," Louis L. Stott, Polymer Corp.
"Basic Fluidized Bed Process and Its Modifications," Joseph Gaynor, General Electric Co.
"Fluidized Bed Processing Equipment," Cecil W. Armstrong, Armstrong Products Co.
"Thermoplastic Coating Powders," F. N. Nagel, National Polymer Products, Inc.
"Thermosetting Coating Powders," Harry Howard, Shell Chemical Co.
"Applications for Fluidized Bed Powders," Robert L. Chockle, E. I. du Pont de Nemours & Co.
"Application Problems Associated With Fluidized Coatings," Newman Henry, Westinghouse Electric Corp.

Names of speakers and papers for Session IV, which will be a forum on printed circuit processing problems, have not been announced as yet. Five speakers have been invited, and the session will be moderated by Paul E. Ritt, Melpar, Inc.

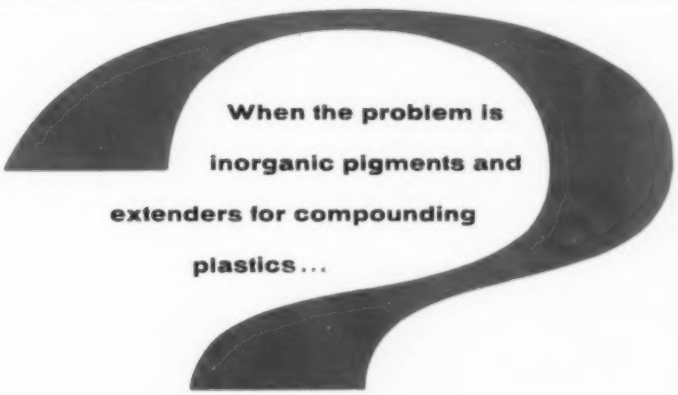
SPE North Texas Section

"Designers Look at Reinforced Plastics From the Pleasure Boat, Aircraft, and Missile Industries Viewpoint," will be the topic covered by SPE North Texas section's RETEC. The program is scheduled for April 28 at the Adolphus Hotel, Dallas, Tex. Luncheon speaker will be J. E. Fitzgerald, Brunswicke-Balke-Collender Co., who will discuss "Plastics in Russia." Additional information and registration forms can be obtained from William McConnell, Air Accessories, Inc., 1400 Henderson St., Fort Worth, Tex. Papers scheduled include:

8:45-11:30 AM Session I—Aircraft & Missiles

"General Problems Encountered," Albert G. H. Dietz, MIT.
"Characteristics and Analysis of Reinforced Plastics for Electrical Applications," Samuel Oleesky, Zenith Plastics Co.
"Structural Characteristics and Analysis of Reinforced Plastic Parts," R. W. Matlock, Summit Industries.
"Various Processes Used in Fabricating Reinforced Plastic Parts," Benjamin Sokol, Republic Aviation Corp.
"Resins and Reinforcements for Use in Reinforced Plastics," J. V. Young, Chance Vought Aircraft.

2:00 PM Session II
"Why Design Quality into Reinforced Plastic Boats?" Clint Haig, Libby-Owens-Ford Co.
"Industrial Designer Looks at Reinforced Plastics," Fred M. Gore, Industrial Design.
"Design Influences on Engineering Reinforced Fiberglass Boats," Dow Moore, Ferro Corp.
"A Market Man Looks at Design," Owens-Corning Fiberglas Co.



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Names in the News

Chris A. Stiegman

Alvin F. Shepard

Chris A. Stiegman has been appointed director of research for Hooker Chemical Corp., embracing both chemical and plastics research. Dr. Stiegman formerly served as technical director. Other Hooker appointments include **Alvin F. Shepard** as general manager of plastics research, **J. Howard Brown** as manager of chemical research, and **James S. Sconce** as technical assistant to Dr. Stiegman.

A number of key managers have been appointed within Shell Chemical Corp.'s newly-created plastics and resins division. **W. C. Lowrey** becomes marketing manager; **F. M. McMillan,** manager of research and development; **D. B. Luckenbill,** manager of operations; **D. P. Jones,** sales manager; **J. G. Dickerson,** sales development manager; **J. F. Roorda, Jr.,** manager of process development; and **D. S. Herr,** manager of product development. Named as district managers are **D. F. Bradley,** Cleveland; **J. R. Brady, Jr.,** Chicago; **G. F. Metzinger,** Los Angeles; and **D. M. Neely,** New York.

William H. Healy

William H. Healy has been appointed new products manager for Air Reduction Chemical Co., division of Air Reduction Co., Inc. A newly-created post, it marks another step in the firm's expanding customer service program.

Russell B. Keller, Jr., has joined the project engineering staff, plastics engineering department, at Goodyear Aircraft Corp. He is currently engaged in engineering a portion of the tracking antenna and support structures the firm is producing for the U. S. Air Force's Ballistic Missile Early Warning System.

Charles E. Hurtle has been promoted from chief engineer to sales engineer specializing in blown film, flat film, and monofilament equipment at Robbins Plastic Machinery Corp., Elkhart, Ind. He is succeeded by **James I. Tweedy.**

Leo W. Ziemlak will handle technical information processing at Foster Grant's research and development laboratories. Dr. Ziemlak previously served as a supervisor at Goodyear Atomic Corp.

Thomas Kreiner

Thomas Kreiner has been appointed southwest regional sales manager for Carlon Products Corp., Aurora, O. He will maintain offices at the firm's Corsicana, Tex., plant and will supervise sales of plastic pipe and fittings in that state, Louisiana, Oklahoma, eastern New Mexico, and the mountain states. He previously sold Carlon pipe in the Midwest, and was more recently sales manager of Western Plastics.

William Buckingham has been named assistant production manager of custom molding at Watertown Mfg. Co., Watertown, Conn. A 14-year employe, he previously directed custom molding shipping and receiving.

Edward A. Dalmas has been appointed assistant manager of the southern sales territory for Becco Chemical division, Food Machinery & Chemical Corp. He previously served as a salesman in the area.

Herbert J. Weber

Herbert J. Weber, one of the founders of Rotuba Extruders, Inc., a division of Waljohn Plastics, has been elected president of the New York Section, Society of Plastics Engineers, Inc. Well known in the plastics industry, Mr. Weber has assisted the Bureau of Ships Specifications Department of the Navy and the G.S.A. division in developing designs, specifications, and test procedures for plastic hand-tool handles. He is also chairman of the Plastics Education Commission for the New York City Board of Education.

Archie C. Anderson

Archie C. Anderson has been named technical director of the A. O. Smith Corp.'s new reinforced plastics division. He joined the firm six years ago, and had been heading the firm's rp-development laboratory. **Dwight H. Davis** was appointed controller and administrative assistant.

Anver S. Suleiman has been elected vice president and general manager of Valco, Inc., St. Petersburg, Fla., after leaving the industrial applications department of Monsanto's plastics division. The firm will manufacture glass-polyester paneling.

OBITUARY

Justin Zenner

Justin Zenner, for many years the Chicago area representative for Injection Molders Supply Co., died on January 24. He was born in Germany in 1891, and was educated in that country. A pioneer sales representative for machinery used in the plastics industry, Mr. Zenner is survived by a son, Walter, and a daughter, Mrs. Eve Veis. Burial services were conducted at Piser Chapel in Chicago.

Success Story for

VAN DORN

Model H-260

Port Erie Plastics, Inc., Erie, Penna., reports that their Van Dorn H-260's:—

"Save about 25% on cycle time."

"Give faster set-ups, and less waste in purging from one material to another."

"Are extremely fast, versatile and economical."

Port Erie Plastics has been operating their Van Dorn presses 24 hours per day, 6 days per week. They mold a variety of products using styrene, polyethylene, polypropylene, and nylon.

Van Dorn Model H-260's are 2½-ounce capacity presses featuring a High Capacity Heater. Other Van Dorn models have capacities from 1 oz. to 6 oz. Write for full details.

THE VAN DORN IRON WORKS CO.
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Van Dorn
Established 1872

The "something more" we try to give each customer who buys our OXO ALCOHOLS

For more than three years we have been providing our customers for Oxo Alcohol with technical service on the use of our material. We work with them on their process difficulties. We endeavor to show customers how to accomplish savings on both processing and time by taking full advantage of the superior quality of our alcohols. The better and more consistent initial quality of Amoco Oxo Alcohols results in crude esters that require less bleaching to meet color specifications. Also, less trouble is encountered with the re-use of unreacted alcohol.

The extremely low carbonyl content, excellent esterification color, acid color, and storage stability of Amoco Oxo Alcohols has resulted in these products finding widening application in the manufacture of ester plasticizers. Manufacturers of didecyl phthalate plasticizers in particular are finding the "something more" in Amoco Decyl Alcohol. DDP made from Amoco Decyl Alcohol produces vinyl compounds with excellent mechanical properties. The superior permanence properties of Amoco Decyl-derived DDP makes such plasticizers particularly suitable for vinyl compounds used in electrical applications.

Perhaps we may be of assistance to you. We will give your inquiry immediate attention.

AMOCO CHEMICALS

AMOCO CHEMICALS CORPORATION
910 South Michigan Ave., Chicago 80, Illinois

New Materials

Write item numbers on Readers' Service Card (p. 89) to obtain more information.

Three Rigid Vinyl Sheets

Three rigid vinyl sheeting materials, each offering a specific improved property, are available from Union Carbide Plastics Co. Designated VCAB-3603, -3604, and -3606, these materials retain all of the physical and chemical properties common to the vinyls and can be machined, drilled, trimmed, and vacuum formed in the usual manner.

VCAB-3603 is formulated for applications requiring high impact strength, while VCAB-3604 is made for greater light stability. Both are available in calendered sheet form or as press-planished individual sheets, 20 by 50 inches in size. Thicknesses range from 0.007-0.030 inches, and the latter material can be supplied with translucent or opaque qualities in a variety of colors. VCAB-3606 is designed for high heat resistant application. Available in clear and translucent white formulations, this material is produced with a maximum thickness of 0.020 inch. Maximum width for all three types is 51½ inches.

Physical properties include:

	VCAB-3603	VCAB-3604	VCAB-3606
Tensile strength, psi	7,000	7,500	8,000
Flexural strength, psi	10,500	10,000	11,000
Modulus of elasticity in tension, psi	350,000	340,000	380,000
In flexure, psi	380,000	380,000	400,000
Izod impact, ft.-lbs./in. notch	15	—	1.2
Water absorption, 24 hrs., 23° C., %	0.06	0.07	0.09

Readers' Service Item 1

Four Fused Teflon Tapes

Four grades of skived Teflon tapes, which can be used for high temperature and high frequency wire or cable insulation, have been added to the product line of Continental-Diamond Fibre Corp. Available in a number of widths ranging from ¼-12 inches in ⅛-inch increments, these tapes also can be used as stock for small gaskets and seals, or supplied with a cementable back for other applications.

Grades ST-X and ST-C have the best electrical and mechanical properties, and the latter is available in nine colors to meet MIL-STD 104. ST-1 is the standard grade and is suitable for most applications which do not require exceptionally high electrical properties. ST-2 offers the advantage of lower cost and can be used where virgin material is not specified. Thicknesses up to 0.1-inch can be obtained in grades ST-X, ST-C, and ST-1, and up to 0.060-inch in ST-2

Properties common to all four tapes include: specific gravity, 2.2; coefficient of friction/polished steel, 0.04; hardness, Shore D, 100 °F., 50; dissipation factor, all frequences, 0.0003; and arc resistance, sec., over 250. Other properties include:

	ST-X	ST-C	ST-1	ST-2
Tensile strength, psi.:				
0.002-in. thick	3,800	3,200	3,300	2,200
0.004-in thick	4,000	3,400	3,600	2,300
Elongation, %:				
0.002-in. thick	270	240	220	110
0.004-in. thick	300	250	260	180
Dielectric strength, vpm.:				
0.002-in. thick	2,900	1,700	1,800	—
0.004-in. thick	2,700	2,000	2,100	1,000

Readers' Service Item 2

Epoxies, Too! Now, Emery offers these three Plastolein® Epoxy Plasticizers:

PLASTOLEIN 9213 EPOXY

This monomeric plasticizer is an epoxidized fatty ester that imparts an excellent degree of heat and light stability to vinyls while contributing to their low temperature flexibility.

PLASTOLEIN 9214 EPOXY

Also a good stabilizing low temperature plasticizer, 9214 is similar to 9213. However, its higher oxirane oxygen content imparts an even greater degree of heat and light stability.

PLASTOLEIN 9232 EPOXY

A polymeric epoxy plasticizer, 9232 is typical of the highest quality currently available. It features extremely low extraction and volatility properties, while providing a high degree of heat and light stability.

For Details, MAIL Coupon Now!

Emery INDUSTRIES, INC.

Organic Chemical Sales Department
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Please send me Technical Bulletin No. 413, "Plastolein Epoxy Plasticizers".

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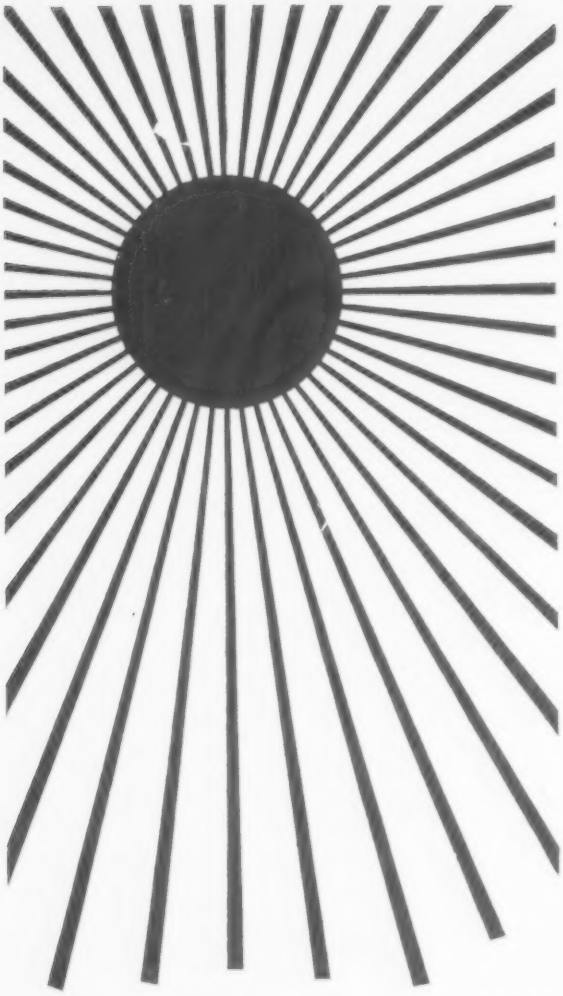
COMPANY.....
ADDRESS.....
CITY.....STATE.....



MERCURY-CADMIUM REDS

LITHOPONES - TONERS

SUPERIOR DISPERSION
EASY DRY-COLORING

WRITE FOR SAMPLES AND BULLETIN 29, COLOR CARD

Kentucky Color
AND CHEMICAL COMPANY, INC.

Subsidiary of
The Harshaw Chemical Company
Louisville 12, Kentucky

Styrene-Methyl Methacrylate

A thermoplastic copolymer of styrene and methyl methacrylate has been introduced as a new family of plastic molding materials by Dow Chemical Co. Tradenamed Zerlon 150, this material handles like the higher heat resistant polystyrene formulations and can be processed on conventional equipment.

Crystal clear and having good outdoor weatherability, Zerlon 150 is expected to find application in the automotive appliance and sign fields. It can be extruded readily into various shapes and sheeting. Metering type screws with a rapid compression section are preferred and best results are obtained with length to diameter ratios in excess of 18:1 While exact operating temperatures depend on screw design, screw diameter, and type of die, some typical conditions for extruding Zerlon 150 would be:

Hopper zone	Water Cooled
Rear zone, °F	350-390
Middle zone, °F	390-420
Torpedo zone and die, °F	400-430

The copolymer is slightly hygroscopic and may require drying before molding or extrusion even though it is specially packaged to reduce or prevent moisture pick-up. Since it is incompatible with other thermoplastics, the injection cylinder must be purged before molding. Maximum physical properties and surface gloss are obtained with cylinder temperatures between 400-550° F. and mold temperatures of 140-280° F.

Average property values, as determined in the laboratory with ASTM methods, are listed below. These are intended to serve as guides rather than specification limits.

Tensile strength, psi.	9,000
Elongation, %	4-5
Tensile modulus, psi.	4.7×10^5
Flexural strength, psi.	17,600
Modulus, psi.	5.1×10^5
Izod impact strength, ft.-lbs./in. notch	0.4
Hardness, Rockwell M.	78
Heat distortion temp., 264 psi., annealed, °F.	205
Coefficient of linear thermal expansion, in./in./°F.	3.7×10^{-5}
Flammability, in./min.	1.7
Dielectric constant:	
10^3 cps.	3.13
10^6 cps.	2.81
Dissipation factor:	
10^3 cps.	0.0246
10^6 cps.	0.0193
Refractive index	1.533
Luminous transmittance, %	>91
Water absorption, 24-hrs., %	0.2
Specific gravity	1.14
Mold shrinkage, in./in.	0.002 – 0.006

Readers' Service Item 3

Heat Resistant Polyester

A styrene-modified, rigid polyester developed for strength retention in the 350-400° F. range is being marketed by American Cyanamid Co. An addition to the Laminac series, designated 4104, this resin can be cured at room or elevated temperatures and is suitable for use in heating ducts and similar structures.

The liquid resin is a clear, light straw color, and has the following characteristics:

Viscosity, poises*	50
Specific gravity	1.129
SPI cure data:	
Gel time, min	4.5
Time to peak, min.	5.5
Peak exotherm, °F	430

* Brookfield, 77° F.

Catalyzed with 0.5% benezoyl peroxide, 0.5% MEK peroxide, and 0.004% cobalt metal, a typical, 31% resin laminate using 12-ply ECC 181-136 glass cloth exhibits physical properties as as follows:

Flexural strength, 77° F., psi	71,000
160° F., psi	67,000
Modulus, 77° F., psi. x 10^6	3.2
160° F., psi. x 10^6	2.81
Tensile strength, psi	49,700
Compressive strength, psi	41,000
Hardness, Rockwell M	114
Barcol	77
Specific gravity	1.89
Water absorption, 24 hrs., 77° F	0.10

Readers' Service Item 4

Glass Fiber Mat and Tapes

An epoxy resin-impregnated, glass fiber laminating material has been developed by the Houze Glass Corp., and is being marketed by Materials & Processes, Inc. Known as Houze Hi Mod, this fabric is available in either of two resin contents, which are in mat or tape form.

Uncompressed Houze Hi Mod is approximately 0.018-inch thick, but under laminating pressure squeezes down to between 0.008-0.012 inch per ply. It can be bonded readily to standard honeycomb core materials, and extremely high modulus and tensile properties make it ideal for sandwich structures. The fiber-resin distribution is uniform lending high burst-strength and hoop-stress values for tubular applications.

Type I, which has a 22-25% resin content, is recommended for isotropic, bi-directional, or tube winding applications. Used in isotropic or bi-directional laminates, this material can give reproducible values for flexural strength and modulus which, respectively, are greater than 160,000 psi. and five million psi. Type II has a resin content of 14.5-18%. It is used in unidirectional laminates and gives flexural strengths not less than 180,000 psi., and moduli not less than seven million psi. Both types are available in mat form, 13 by 38 inches, and in two- and three-inch width tapes.

Readers' Service Item 5

Polyethylene Wax

A low molecular weight polyethylene wax, tradenamed Epolene LV, has been added to the product line of Eastman Chemical Products, Inc. It can be used as a modifier for paraffin, an additive for rubber and plastics, and as an ingredient in polishes. Typical physical properties include:

Ring and ball softening point, °C.	103–104
Penetration hardness, 100g./5 sec./77°F., mm.	0.3
Acid number	<1
Saponification number	<1
Color of liquid, Gardner	2
Density	0.925
Flash point, °F.	>600
Fire point, °F.	>600
Bulk factor, lbs./ft.^{3}	30
Viscosity, Brookfield, cps.:	
120° C.	360
160° C.	145
Cloud point, (130° AMP paraffin), °F.:	
1% Epolene LV	165
5% Epolene LV	180

Readers' Service Item 6

Strontium Chromate Pigment

A clean, primrose shade, yellow pigment which is easily ground and has very good light resistance both in full shade and in tints, is available from Sherwin-Williams Co.'s pigment, color, and chemical division. Designated Strontium Chromate 12170, this colorant is somewhat similar in shade to primrose chrome yellow, but has considerably superior heat and light stability. It is used to produce pastel shades in PVC compositions, and in polyvinyl butyral compositions for metal protective coatings. Properties include:

Specific gravity	3.84
Weight/solid, lbs./gal.	31.99
Bulking value, lbs./gal.	0.03126
Oil absorption	23

Readers' Service Item 7

BIPEL
Have You Seen BIPEL?
Smart American molders have seen . . . and installed . . . BIPEL equipment. They wanted these Compression-Transfer Presses for greater production, economy and dependability . . . fully or semi-automatic, or manual control . . . a wide choice of capacities up to 660 tons. And BIPEL Preformers, too, to get better preforms, faster, with controlled hydraulic action!
Demonstrations and Service at Tiverton
B.I.P. Engineering Ltd. Sutton Coldfield, England
RALPH B. SYMONS ASSOC., INC.
3571 Main Road, Tiverton, R. I.

New Equipment

Write item numbers on Readers' Service Card (p. 89.) to obtain more information.

Acromark's two-color marking head.

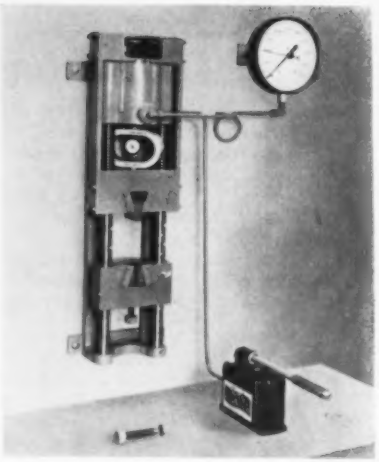
Two-Color Marking Head

A two-color marking head which, while designed for the Acromark Model 250H Pneumatic Hot Stamping Press, can be adapted for use in other types of hot stamping press, has been made available by Acromark Co. The head features an independent feed adjustment for each of two different colors, and incorporates the roll-leaf holder, guide, dual feed roll, and adjustments, complete in one unit.

Maximum roll-leaf feeds are six inches on one advance, eight inches on the other. Maximum die area is seven by eight inches when a solid, engraved die is used. If two-color rolls are used, their widths may total up to seven inches; while roll leafs up to seven inches wide can be accommodated for single color operations.

Interchangeable cartridge heaters require a 115-volt power source, deliver a total of 660 watts, and produce temperatures up to 550° F. Temperatures are controlled by a Robertshaw Controller with dial type setting or, if desired, the unit can be equipped with a Wheelco Temperature Controller of the proportioning type.

Readers' Service Item 21



Steel City Testing Machines' wall-mounted tensile tester.

Readers' Service Item 22

Wall-Mounted Tensile Tester

A wall-mounted tensile tester, for use where bench space is at a premium, has been made available by Steel City Testing Machines, Inc. The hydraulic cylinder and jaw units, as well as the 8½-inch diameter pressure gage are mounted on the wall, and the only bench space required is for the hydraulic pump with integral oil reservoir base which occupies an area of three by eight inches.

Tests can be made on flat or round specimens with sufficient accuracy for laboratory use, and rapidly enough for production. The specimens are gripped by wedge-type jaws which are manually tightened by adjusting screws. Pressure is built up by closing an operating valve and working the pump handle up and down until the specimen yields.

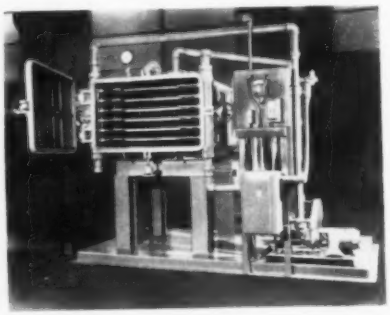
The gage incorporates a pressure indicator which is carried along by the pressure hand and holds at the peak load. When the test is completed, the operating valve is opened, the ram returns to its original position, and the oil flows back to the reservoir. After resetting the maximum pressure indicator, the apparatus is ready for the next test. Models are available with maximum capacities up to 40,000 pounds. Other characteristics include:

Cylinder stroke, in	1.75
Length of specimen, max., in	13
Min., in	5
Capacity of flat jaws, thickness, in	0.375
V-type jaws, optional, in	0.75
Over-all dimensions:	
Width, in	14.75
Length, in	33.5
Height, in	16
Net Weight, lbs.	220

Vacuum Dryer for Plastics

Heat sensitive plastics, as well as other types, can be dried before processing, with the Devine Vacuum Chamber Dryer which has been introduced by J. P. Devine Mfg. Co., Inc. This dryer consists of an electric water heating system, a vacuum pump, inter-connecting piping, vacuum chamber, and a control panel.

Field trials have shown that DuPont 31 nylon containing as much as 3% moisture can be dried in approximately 4-6 hours, and scrap nylon, approximately ⅛-inch in size, can be dried in 12-14 hours. These dryers are available in standard sizes ranging from 2-846 square feet effective pan size, or they can be built to meet requirement.



Devine Vacuum Chamber Dryer.

Readers' Service Item 23

RONA™

SYNTHETIC

PEARL PIGMENTS

FOR COMPOUNDING INTO

- POLYETHYLENE
- POLYSTYRENE
- VINYL
- ACETATE
- NITRATE
- ACRYLICS
- CASEIN
- POLYESTERS
- PHENOLICS (CAST)
- ACRYLICS (CAST)
- POLYPROPYLENE

and other resins

COATING ALL SURFACES

Rona Pearl Pigments are heat and light stable, non-reactive non-corrosive, and impart high pearly luster, exceptional depth and brilliance at very low cost.

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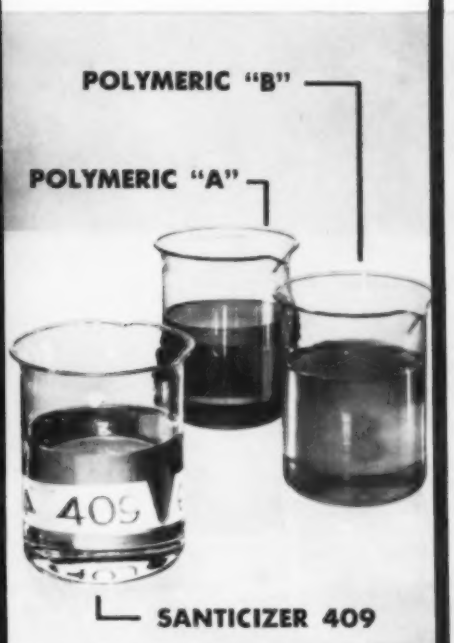
RONA LABORATORIES, INC.

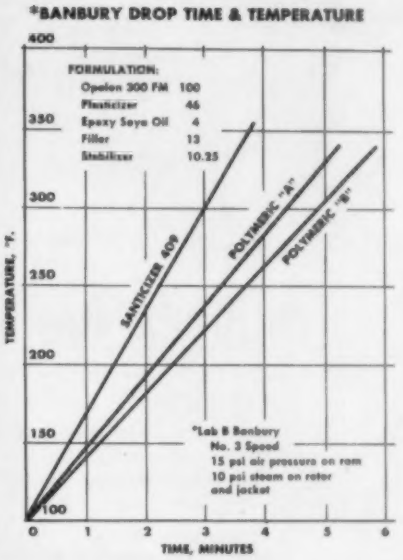
East 21st and East 22nd St., Bayonne 7, N.J.

Manufacturers of Pearl Essence exclusively

Plants: Maine New Jersey Canada

Monsanto's new SANTICIZER 409 gives "high-priced" properties at the lowest cost of any polymeric plasticizer!





"Permanent" Benefits

To end summer "fog-up" on car windows from plasticizer volatilization (the most urgent problem confronting vinyl upholstery and coating producers), SANTICIZER 409 offers the best, lowest-cost answer. Simulated service tests prove it stays in the product longer than many higher-priced polymerics. SANTICIZER 409 is less volatile, does not migrate or exude—even in high humidity—as do many other polymeric plasticizers. Also, it is more resistant to extraction by soapy water, alkalies, solvents and oils, and has superior electrical properties.

Lighter Color, Lower Odor

Compared to two commercial polymeric plasticizers (above), SANTICIZER 409 has a lighter, clearer color and far less odor. Its good heat and light stability help finished products retain their true colors, plasticity, attractive appearance and other important physical properties. SANTICIZER 409 contains no flocculent matter or sediment to cause spotting in thin films, transparent sheeting and similar products. Its high purity contributes to excellent electrical properties in vinyl insulating compounds.

Fastest Fusion

SANTICIZER 409 speeds the fusion of vinyl compounds faster than many other polymerics. Its high solvating power, low viscosity and plasticizing efficiency may cut your processing time, or improve your compound's physical properties within your processing temperature limitations. SANTICIZER 409 mixes readily with a variety of monomeric plasticizers and is highly compatible with cellulose acetate butyrate, nitrocellulose, polyvinylidene chloride and PVC.

If you now use or can use a polymeric-type plasticizer, you can't afford *not* to evaluate new SANTICIZER 409. Use-rated and job-proved, it can give you exclusive advantages *at lowest cost* in products such as: electrical-grade plastisols; coatings for moisture and corrosive-fume protection of dishwashers, ventilator ducts and similar products; long-service profile extrusions such as refrigerator gasketing; coated fabrics, film and sheeting, adhesive-backed tapes and free films.

Write on your company letterhead for a sample of SANTICIZER 409 and compounding help from Monsanto's Plasticizer Council.

SANTICIZER: Monsanto T.M., Reg. U.S. Pat. Off.

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IN
APPLICATIONS
FROM
A
TO
Z

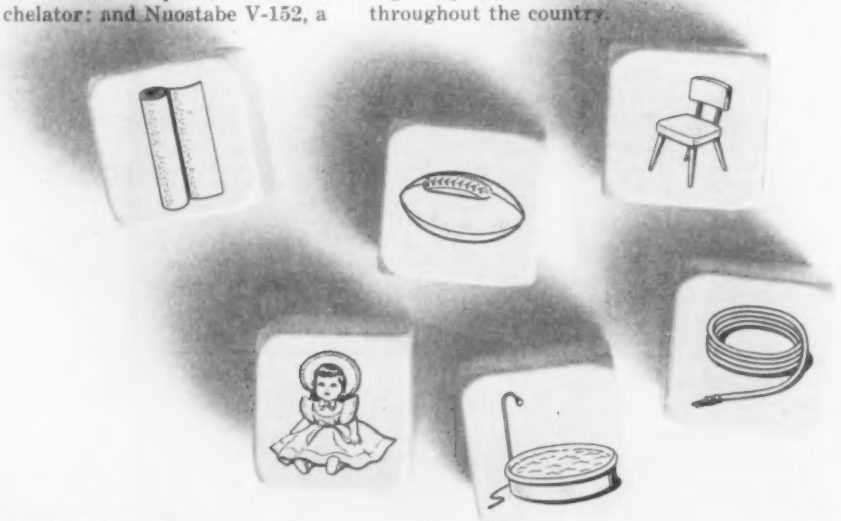
NUODEX stabilizer know-how assures top performance

and provides you with the building blocks for highest quality in your product line at minimum cost.

Whatever your process—plastisols, extrusion, calendering—turn to Nuodex application research for Vinyl Stabilization Systems which provide maximum heat and light stability at lowest cost.

Nuodex technical specialists have solved many difficult stability problems by developing systems made up of specific combinations of tested and proved Nuostabes®, three of which are basic. Nuostabe V-132, a Barium-Cadmium complex; Nuostabe V-142, an organic chelator; and Nuostabe V-152, a Zinc complex. Complementing this primary group, Nuodex offers a full line of "Uniformity Certified" stabilizers for special applications including the economical *liquid* Barium-Zinc complexes, Nuostabes V-12 and V-14.

Nuodex application research, backed by a fully staffed laboratory, is prepared to help you cut your production costs by developing systems to meet your specific needs. To assure you of a dependable source of supply, Nuodex also maintains a network of strategically located warehouses and sales offices throughout the country.



For complete product specification data, write to

NUODEX special purpose chemicals for industry

NUODEX PRODUCTS COMPANY • ELIZABETH, NEW JERSEY

A Division of Heyden Newport Chemical Corporation

Fungicides • Nickel Salts • Organic Peroxides • Paint Additives • Stearates • Vinyl Additives

Seelye auto-feed plastics welder.

Auto-Feed Plastics Welder

Welding of thermoplastic materials, both plasticized and unplasticized, can be expedited with a high-speed auto-feed plastics welder which is being marketed by Seelye Craftsmen. Welding speeds up to 48 inches per minute on simple, flat, or curved surfaces have been reported.

The welder passes air or nitrogen over electrical heating elements where it is heated. As in any welding operation, the hot gases are directed at the rod and the material so that fusion takes place. Five interchangeable elements, ranging from 180-600 watts and wired 110 volt, a.c., provide a sufficient range of temperatures to handle all types and sizes of rod. The auto-feed tip is designed with an integral rod holder and gas nozzle. This combination directs the rod and gases in a converging relationship to achieve optimum welding conditions.

Readers' Service Item 24

Preheating and Drying Oven

A preheating and drying oven, designed specifically to reduce moisture content in

Despatch Oven's model PLHD-2-5.

INSTRON

a new dimension in precision plastics testing

Viscoelastic Properties from Stress-Strain Data

Can viscoelastic properties of rubber-like materials be predicted from stress-strain data?

Here's how the problem was approached in a recent study. Stress-strain curves for polyisobutylene were developed on an Instron at several different strain rates and temperatures. Then, points on the curve were reduced mathematically to a single logarithmic stress-strain curve. Dynamic viscosity and stress relaxation modulus obtained from the data were compared with published experimental values.

The result? You can find it in Instron Bulletin PC-2, which describes this interesting study in full. It is one of many technical articles on advanced testing techniques from reliable, independent sources now available to you in reprint form. Just write

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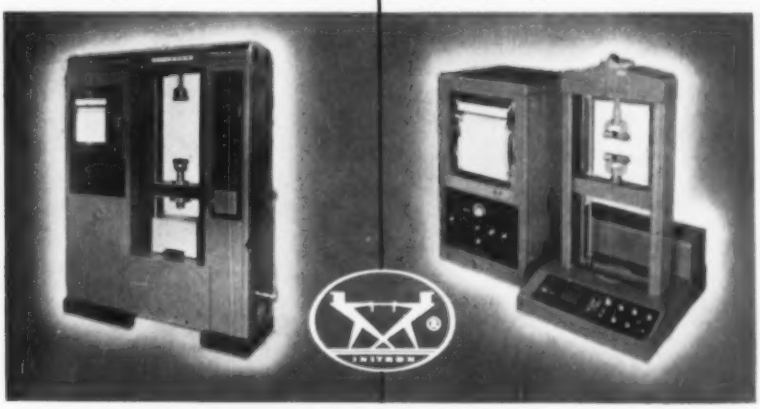
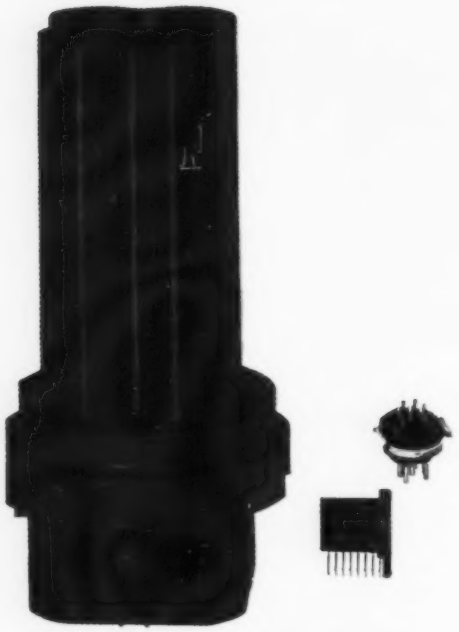
2501 WASHINGTON STREET, CANTON, MASS.
EUROPEAN OFFICE: SEEFELDSTRASSE 45, ZURICH, SWITZERLAND

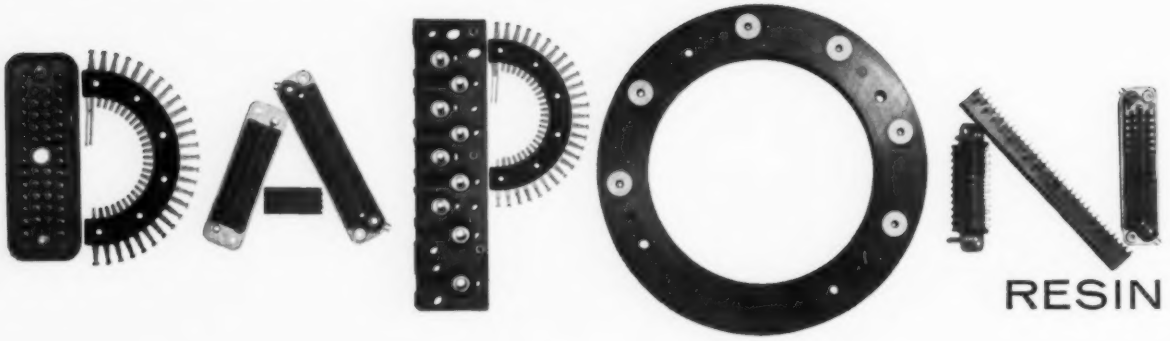
FLOOR MODEL INSTRON — *full scale load ranges: 2 grams to 10,000 pounds.*

TABLE MODEL INSTRON — *full scale load ranges: 2 grams to 200 pounds.*



DAPON® (DIALLYL PHTHALATE) RESIN FOR SUPERIOR ELECTRICALS





DAPON® resin (diallyl phthalate prepolymer), a preferred and frequently the only acceptable material in military and space technology applications, is equally well suited to a wide range of industrial uses. Molded DAPON resin parts are widely used today by the leading companies in the electronics industry.

Electrical parts molded with DAPON resin are unexcelled for retention of dielectric strength, insulation resistance and arc resistance even under conditions of high humidity and elevated temperatures. DAPON resin's unusual stability eliminates breakdown and attendant corrosion of metallic electronic components. And the exceptional dimensional stability of DAPON resin permits molding of complex parts with multiple inserts as well as close tolerances without machining. For use at higher temperatures another form of DAPON, named DAPON M resin (diallyl isophthalate prepolymer), is also available.

FMC manufactures the basic DAPON resin only and does not supply finished molding compounds. DAPON resin molding compounds are available from:

ACME RESIN CORPORATION 1401 Circle Avenue Forest Park, Illinois	as	Acme Diallyl Phthalate Molding Compounds
DUREZ PLASTICS DIVISION Hooker Chemical Corp. North Tonawanda, N. Y.	as	Durez Diallyl Phthalate Molding Compounds
MESA PLASTICS COMPANY 11751 Mississippi Avenue Los Angeles, California	as and	Diall® (Diallyl Phthalate) Molding Compounds Diall® (Diallyl Isophthalate) Molding Compounds
ROGERS CORPORATION Rogers, Connecticut	as	Rogers Diallyl Phthalate Molding Compounds

For complete information about DAPON resin's outstanding electrical properties and how it can help solve your problems, write to FMC Chemicals and Plastics Division.

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chemicals and Plastics Division

161 EAST 42ND STREET, NEW YORK 17, N. Y.

resin materials prior to molding, has been placed on the market by Despatch Oven Co. Designated PLHD-2-5, this unit is a drawer type oven, equipped with a dehumidifier, and capable of delivering temperatures up to 450° F.

A forced draft system moves air across a 7½-KW heater located in an insulated chamber in the lower part of the oven. The heated air travels up a distributing duct, and is discharged horizontally across drawers, after which it enters a recirculating duct on the opposite side. Louvered dampers permit control of air flow, and an indicating heat control, pilot light, toggle switches, and motor starters also are provided.

Relative humidity of the inlet air is lowered by a dessicant type dehumidifier, and a water-coil cooling system is included for optional use during hot, humid, weather. The double-wall construction encloses three inches of mineral wool insulation. Over-all dimensions in inches are: width, 72; depth, 40; and height, 58. The oven contains 10 drawers, each measuring 20 by 30 by 3½ inches.

Readers' Service Item 25

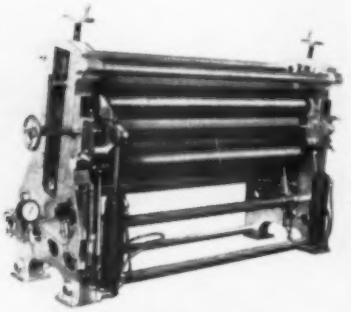
Embossing Roll Stand

A heavy duty, embossing roll stand which can be used independently or integrated into an existing processing line has been made available by Development Engineering Co., Inc. Of simple, rugged construction, this machine is designed to handle up to 15,000 psi. on each journal.

Web height is adjusted by means of hand-wheel-operated screw rods which raise or lower the top roll. The bottom roll is positioned by a hydraulic system, which also builds up and maintains the desired pressure. A hand pump and pressure gage are provided for this purpose. Pressure is relieved and the roll is lowered by opening a valve which recirculates the oil to the low pressure side of the system. Machined pads are provided on each end-casting for locating pillow blocks, Mount Hope rolls, or other equipment.

Optional equipment available with this unit include: cooling and idler rool equipment; back-up rolls; variable speed drive; and thermostatically controlled pre-heating equipment.

Readers' Service Item 26

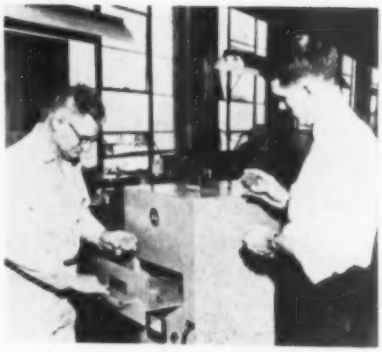


Develco's embossing roll stand shown with embossing roll and rubber roll in place, and miscellaneous extras.

HF Dielectric Heating Unit

A high frequency dielectric heating unit which radically reduces preheat time for small loads of plastics preforms, has been added to the Thermex line produced by Chemetron Corp.'s Girdler Process Equipment Division. Known as Model 3RC, this unit heats three-ounce loads of melamine or mica-filled phenolics to 240° F. in just four seconds; 2¼-pound loads in one minute.

The preform tray is lighted by a fluorescent tube, and a radio frequency of about 100 megacycles is delivered through a 10- by 10-inch electrode which can be positioned between one and four inches of the tray. This unit requires one 5762/7624 oscillator and four 872A rectifiers. Power source should be 230-volt, 60-cycle, single-phase; although a step-down transformer can be used where 460-volt outlets prevail.



Girdler's Thermex Model 3RC.

Controls are located on the front of the cabinet and include a plate meter, load cycle adjustment, and main circuit breaker. Electrode adjustment is located on top of the cabinet. The unit has an aluminum casing, and the entire assembly is mounted on rubber-tired wheels. Dimensions in inches include: height, 50½; width, 21; and depth, 24. Net weight is 275 pounds.

Readers' Service Item 27

Logan HYDRAULIC PREFORMERS

AUTOMATIC HIGH BULK PREFORMING

- Multiple Cavities
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- Fast Cycles
- Automatic

Automatic Preforming
General Purpose to Rag Filled.
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Plastics Applications

Write item numbers on Readers' Service Card (p. 89) to obtain more information.

St. Croix Mfg.'s epoxy boat.

Epoxies Go To Sea

With the development of a new-type spray gun by A. Gusmer, Inc., epoxy resins are being reinforced with chopped glass fibers to make boat hulls. First company to wet its feet in this competition with polyester mixes is St. Croix Mfg. Co. who exhibited its first epoxy boat at the Eighth National Plastics Show last November.

Development of the Gusmer spray gun has solved the short pot-life problem characteristic of epoxy resin-hardener systems. These formulations not only cure rapidly at room temperature, but previously could be handled only with difficulty and by highly skilled operators.

Semi-skilled operators can handle the Gusmer unit without difficulty. The resins and hardener are kept in separate containers and come in contact only after they have been metered to the gun's chamber where they are mixed and discharged through an orifice under an air pressure of 300 psi. When the trigger is released, a plunger forces the remaining resin-hardener mix through the orifice so that no material is left to clog the gun.

In the manufacturing operation, a mold is coated with a release agent and sprayed with an epoxy gel coat to provide the hull with a smooth exterior finish. Next, the epoxy resin is sprayed on, simultaneously with chopped glass fibers to form a layer of approximately ⅛-inch in depth. Each layer is rolled to insure complete wetting of the fibers and eliminate pin-hole formation.

Epoxy boats are said to be lighter and stronger than those made with polyester. Resin formulation used in this operation is Union Carbide Plastics Co.'s Bakelite ERL-2795 epoxy resin and ZZL-0814 hardener.

Readers' Service Item 41

All-Polyethylene Sink

A three-position polyethylene sink, 72 inches long by 24 inches wide and 36 inches high has been fabricated by Bel-Art Products. Intended for the washing of corrosive acids from transistor elements, the sink has an 18-inch backsplash. Bowls are 16 by 16 by eight inches deep with one- by ¾-inch shelf bars. Fume exhausts are one by 16 inches, and the fume hood is seven by 72 inches tapering to a six-inch diameter stack.

Total weight of the unit, with wooden structure, is about 120 pounds. The polyethylene sheeting is ½-inch thick in the sinks, and the decking, apron, and hood measure $\frac{3}{16}$-inch. The plumbing is also polyethylene, as are the goose-neck spouts which direct the running water away from the operator. All polyethylene parts are welded together and rest on the plywood table.

All-polyethylene triple wash sink.

Readers' Service Item 42

Plastic Veneer

A plastic veneer having a hand-rubbed wood appearance is being manufactured under the tradename Kevinite, by Swedlow Plastics. Basically, the veneer is a polyester resin coating which is applied to both surfaces of a paper on which a characteristic wood finish has been printed.

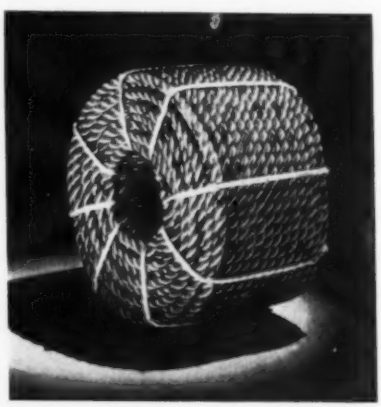
The hand-rubbed appearance is made possible through application of matte-finish polyvinyl alcohol film supplied by Reynolds Metals Co.'s plastics division. The PVA film, which is removed upon installation of the veneer, is applied early in the manufacturing process and transfers its dull finish to the polyester.

These cabinet doors are veneered with Swedlow's Kevinite.

Readers' Service Item 43

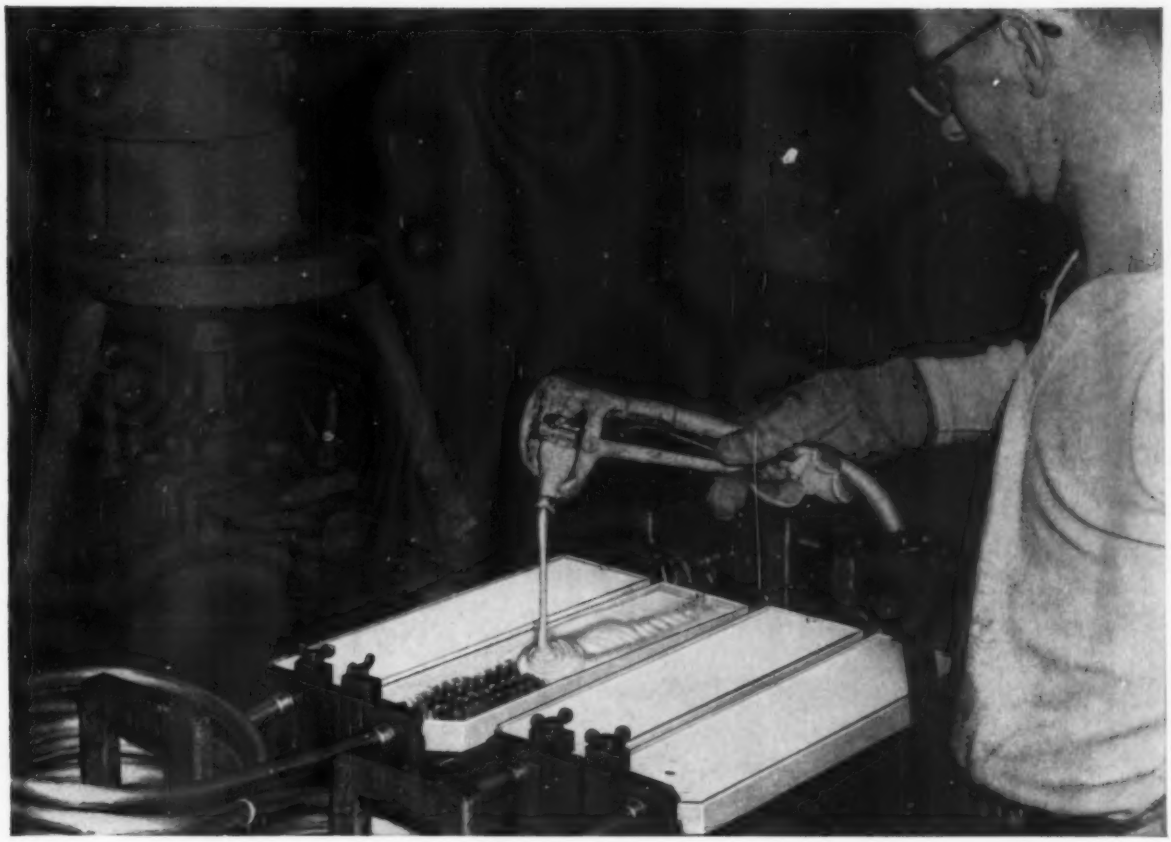
Saran Rope

Columbian Rope Co. has introduced a Saran fiber rope for applications where exposure to chemicals greatly shortens the life of ropes made with regular fibers. Weaker than Manila rope, and about 14% heavier, use of the Saran product is limited to those applications where chemical resistance and non-flammability characteristics are crucial. It is available in lengths up to 2,400 feet and made in the standard sizes of ¼-, $\frac{5}{16}$-, $\frac{3}{8}$-, $\frac{7}{16}$-, and ½-inch in diameter.



Columbian Rope's Saran product.

Readers' Service Item 44



For casting and potting of products for electrical and other industries . . .

GLIDPOL 1008 polyester resin system produces tough castings that resist cracking!

GLIDPOL 1008 polyester resin and its modifications are ideally suited to casting and potting operations. This rigid-type, all-purpose resin is finding wide application in the manufacture of terminal blocks, coils, transistors and other electrical products. It permits hard, tough, moisture-proof castings that resist cracking during conversion. Metal, wood and paper inserts are easily imbedded in the resin.

GLIDPOL 1008 provides excellent abrasion and chemical resistance. It can easily be pigmented in a wide range of colors by the use of GLIDPOL 3000 pigmented bases. Fillers, such as talc, clay, silicas, glass floc and asbestos, may also be added to GLIDPOL 1008.

Whatever products you manufacture, you may be able to achieve faster, more economical production by using GLIDPOL polyester resins. Glidden technicians will help you select the proper resins, catalysts, colors, fillers, and in establishing correct curing schedules. Write now for complete data on GLIDPOL 1008 and GLIDPOL for other fabricating techniques.

LIQUID RESIN PROPERTIES

Viscosity @ 77° F.	800 cps.
Polyester resin content	68%
Weight per gallon	9.45 lbs.

SPI GEL TEST
(1% Benzoyl Peroxide, 180°F)

Gel time	3.1 min.
Peak time	4.5 min.
Exotherm peak	410°F
Pot life @ 77°F	30 hrs.

QUALITY Glidden PRODUCTS

GLIDPOL POLYESTER RESINS

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900 Union Commerce Bldg., Cleveland 14, Ohio

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You Specify The Size

ELECTRIC HEATERS of All Types

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- For Machine Parts
- For Liquids
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ALSO SPECIAL REQUIREMENTS

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ORGANIC PEROXIDES

meet the highest standards of chemical purity and performance. They are widely used in the plastics industry to produce clear, haze-free polymers . . . like polyvinyl compounds, polyethylene, methacrylates, polystyrene, and polyesters.

BENZOYL PEROXIDE
LAUROYL PEROXIDE • MEK PEROXIDE
2,4 DICHLORBENZOYL PEROXIDE
TERTIARY BUTYL HYDROPEROXIDE
in all their many forms

Prompt shipment and service from one of 36 branches located near you.

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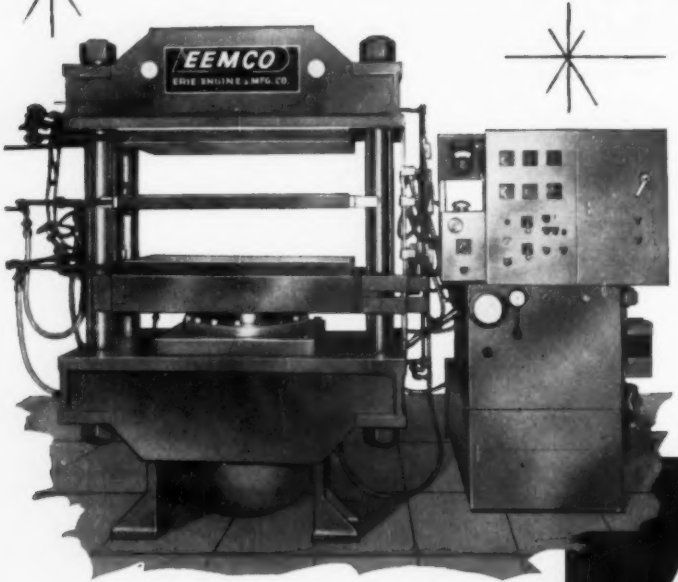
Write to CHEMICAL DEPARTMENT, McKESSON & ROBBINS, INC. FOR INFORMATION, TECHNICAL DATA AND SAMPLES.

HYDRAULIC PRESSES for Rubber and Plastics



Illustrated Compression Molding Press with 314 ton capacity. Platen sizes 45" x 30"—2-10" openings, with semi-automatic controls. EEMCO builds a complete line of Presses for Laminating, Transfer Molding and Reinforced Plastics.

. . . designers and builders of a complete line of MILLS and PRESSES

EEMCO
ERIE ENGINE & MFG. CO.
953 East 12th St., ERIE, PA.

Chemtrol all-plastic ball valve.

Molded Plastic Ball Valves

Four-inch molded ball valves for corrosion service are being molded in PVC, Kralastic, polypropylene, and Penton by Chemtrol of California. The valves are Venturi-throated, and have straight-through, non-turbulent, low pressure drop flow characteristics. All are fitted with 150# flanges. Other features include a ¼-turn shut-off, and provision for seat seal take-up.

Readers' Service Item 45

Self-Locking Nylon Cap Nut

Lehigh Metal Products Co. is offering a nylon, self-locking cap nut for use by the furniture and electronics industries. Called the Relok, the nut has high strength, impact resistance, is rust-proof, and anti-magnetic. The deepest end is left unthreaded so that the forward end of the bolt self-taps itself in place. Various colors and sizes are available. Allied Chemical's plastics & coal chemicals division supplied the Plaskon nylon used in this application.

Relok nylon cap nuts.

Readers' Service Item 46

Bondable Skived Teflon Tape

Korabond is the tradename for Dixon Corp.'s bondable skived Teflon tape, which is reported to be easily fusible without the use of adhesives or chemical treatments. A sintered tape, it can be wrapped on wire and heated to over 620° F. to achieve a tight shrink-fit.

The firm says Korabond can be used to replace Type B unsintered, extruded Teflon tape. Tensile strength is reported to be 30% higher than the regular skived tape. Korabond is available in widths up to four inches and in thicknesses of ½, 1, 2, 3, and 4 mils.

Korabond bondable Teflon tape.

Readers' Service Item 47

Polyethylene Safety Device

Car and other vehicle owners no longer need to flag traffic when they have a flat or motor trouble thanks to a product recently developed by Sentinel Mfg. Co. Called the Safety Sentinel, the device is a 10-inch tall polyethylene cone in bright yellow. When placed 30 and 60 feet away from the disabled vehicle, the Sentinels are visible at 500 feet (for 10 seconds at 40 mph.). Weighing about 10 pounds, they are easily stored in the car's trunk.

Readers' Service Item 48

Step UP
with
Gardsman
MODEL
JP SERIES
PROPORTIONING
TEMPERATURE
CONTROLLER

Pays Plenty in Plastics

See us at the
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Booth #416

This *tube-free* instrument brings many advantages over *any* on-off controller. *Anticipates* temperature change, tends to stabilize at *closer* tolerance. Cuts rejects, maintenance; ends adjustment, tube-replacement. Reliability *Guaranteed*. Write for Bulletin JP-1.

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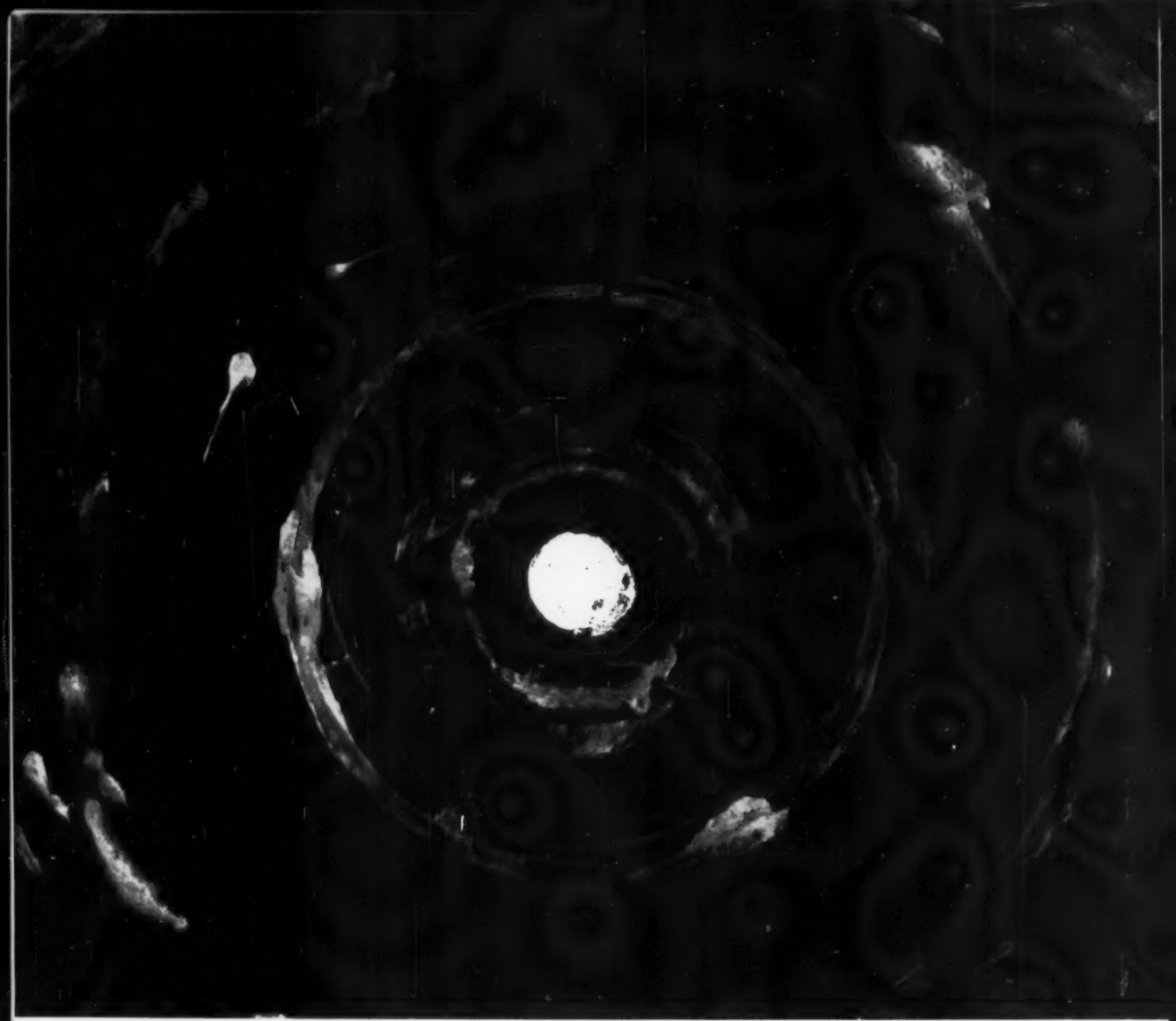


CYASORB*... the biggest brand name in product protection under the destructive sun!

CYASORB Light Absorbers provide the ultimate in protection against damaging ultraviolet. Easily and economically incorporated into most formulations, CYASORB Light Absorbers will actively prevent UV-caused degradation . . . . open up many new markets for *your* product.

IN PVC, for example, CYASORB UV 24 Light Absorber prevents browning, spotting and embrittlement caused by sunlight. During exposure tests in Florida and Arizona, PVC samples treated with 0.2 phr CYASORB UV 24 showed an average life span five times greater than untreated control samples.

IN POLYESTERS, clear unprotected ⅛-inch castings showed pronounced yellowing when exposed to a GE S-1 sun lamp for two hundred hours. Identical samples, with 0.25% CYASORB UV 9 added, showed less yellowing, *even when exposure was increased fivefold.*

IN POLYSTYRENE, samples containing 0.2% CYASORB UV 9 showed 50% less yellowing than untreated controls after 400 hours in Fade-Ometer.

IN SURFACE COATINGS and thin films, CYASORB UV 24 provides outstanding protection to the substrate and to the film itself. An .0008-inch plastic coating containing .004 ounces of CYASORB UV 24 per square foot screened out 91% of the ultraviolet that passed through a similar, but unprotected, system. (Both films were coated on glass.)

These few examples show the effectiveness of CYASORB Light Absorbers even in fractional percentages. If you have a problem involving ultraviolet degradation, Cyanamid's unequaled experience in the use of UV light absorbers is readily at your disposal. Just write us. *Trademark

AMERICAN CYANAMID COMPANY
Intermediates Department
Bound Brook, New Jersey

CYANAMID

New Literature

Write item numbers on Readers' Service Card (p. 89) to obtain more information.

"Injection Molding and Extrusion of Moplen." Chemore Corp. Bulletin 1. 8 pages. Technical data, obtained by Montecatini and its Italian customers during actual production runs with polypropylene, are presented. Areas of moldability of Moplen, hi-impact polystyrene, and low density polyethylene are compared. A trouble-shooting chart for remedying some of the difficulties encountered when molding Moplen is included.

Readers' Service Item 61

"Distirene X, Expandable Polystyrene." British Resin Products, Ltd. Bulletin S3. 12 pages. Physical properties, processing techniques, as well as applications of this material are discussed.

Readers' Service Item 62

"Stan-Tone GPE Colors." Harwick Standard Chemical Co. 1 page. Listed here are the various polyethylene-dispersed colors which are manufactured by Sinclair & Valentine Co. The tabulation gives catalog number, pigment type used, and specific gravity.

Readers' Service Item 63

"Zerlon 150." Dow Chemical Co. 4 pages. No. 171-121. Physical properties and fabrication techniques for Zerlon 150, a styrene-methyl methacrylate copolymer, are given in this pamphlet.

Readers' Service Item 64

"Comet Quick-Pak." Comet Industries. 4 pages. An automatic skin packaging machine, designed for high speed mass production is illustrated in this leaflet. Dimensions for models 22 and 23 are given.

Readers' Service Item 65

"Pfaudler Buyer's Guide." Pfaudler Co. Bulletin 968. 11 pages. Information on glassed-steel and alloy equipment including reactors, flush valves, and an electronic tester are contained in this illustrated booklet. One section is devoted to a general description of Pfaudler's customer services.

Readers' Service Item 66

"Polyester Glass." Continental-Diamond Fibre Corp. 4 pages. Insulation sheets and fabricated parts made of polyester glass-base Dilecto and Celoron laminates are described. Physical properties of Dilecto are listed.

Readers' Service Item 67

"Plastisol Compounds for Roto-Casting Applications." Goodyear Tire & Rubber Co. Tech-Book 58-332. 4 pages. A continuation of Goodyear's Tech-Book Facts series, this illustrated pamphlet discusses rotational molding formulations based on Pliovic AO and S50, Pliovic AO and VO, and Pliovic VO and S50.

Readers' Service Item 68

"Harflex 375." Wallace & Tiernan, Inc. 4 pages. Chemical and physical properties of a polymeric plasticizer are given in this leaflet.

Readers' Service Item 69

"Polyethylene Carbon Black Concentrates." Columbian Carbon Co. Bulletin 178. 2 pages. Copeenblak 703 and 707, two ultra-violet light screeners, are described and two specimen formulations are given.

Readers' Service Item 70

"Thermiphil Standard Indicating Instruments." Bulletin T/VG-Voxx. Atkins Technical, Inc. 4 pages. This catalog lists temperature ranges, prices, and dimensions for the probes and thermometers.

Readers' Service Item 71

"Sun-Tested Velva-Glo Fluorescent Pigments." Pigment Bulletin #103. Radiant Color Co. 10 pages. Actually a demonstration packet, it includes information on the pigments, color swatches, and plastic glasses for viewing same. The firm's product line is described in some detail, along with suggested applications.

Readers' Service Item 72

"Don't Get Stuck—Use Bomb-Lube." Slide rule card. Price-Driscoll Corp. One side of the card lists information for cost estimating and machine loading, and the reverse lists commonly-used plastics with certain physical properties and comparative weights.

Readers' Service Item 73

"Thermophil, The Electronic Thermometer." Bulletin B. Atkins Technical, Inc. 2 pages. The brochure lists individual temperature ranges for various models of three- and four-scale thermistor thermometers. More than 100 probe designs are available, all interchangeable.

Readers' Service Item 74

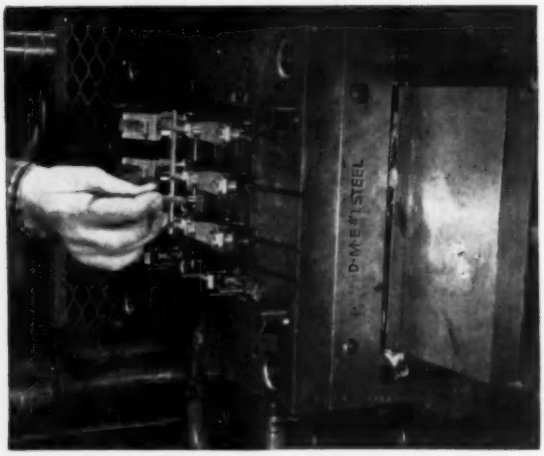
"Aluminum Metalset A4 in Self-Metering Tubes." Smooth-On Mfg. Co. 4 pages. Directions, suggested applications, and data are given for the compound which comes in two tubes. Equal parts of each are mixed to achieve the proper formulation.

Readers' Service Item 75

"Pressure Leaf Filters." T. Shriver & Co., Inc. 7 pages. This illustrated booklet gives structural details of the company's horizontal and vertical pressure leaf filters. Available technical facilities also are listed.

Readers' Service Item 76

6,000 COMBINATIONS



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Whether it's a one-cavity "test" mold or a 60-cavity high production run, chances are D-M-E has the right size Standard Mold Base to fit the job and the molding machine.

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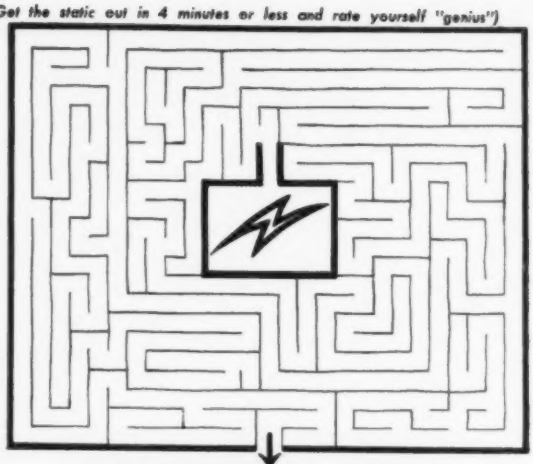

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Book Reviews

"Cellulosics." Walter D. Paist. Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y. Cloth, 5¼ by 6½ inches, 270 pages. Price, $5.75.

The cellulosics, which consist of long chain molecules built up of carbon, hydrogen, and oxygen atoms, are the largest family of polymer derivatives used in the production of fibers, films, and other plastic materials. There are about 40 different compounds which are produced commercially, and more than 120 which differ from both a chemical and viscosity standpoint. The author reviews the chemical structures and physical properties of the major classes of the family including: regenerated cellulose, cellophane, rayon, cellulose esters, and cellulose ethers.

Basic methods of fabrication are discussed with particular emphasis being placed on formation of fibers and fabrics, and cast or extruded film and sheet. Applications are considered in greater detail with separate chapters being devoted to cellulosics which are: extruded and cast; injection molded; used as protective coatings; used as adhesives and binders; and used in fabrics. The concluding chapter examines some of the newer developments which have given us: cellulose triacetate; a new method for preparing cellulose thiourethane; cellulose phenylthiourethane; far-hydrolyzed cellulose acetate; and certain crosslinked cellulose derivatives.

"Radioisotopes—A New Tool For Industry." Sydney Jefferson. Philosophical Library, Inc., 15 East 40th St., New York 16, N.Y. Cloth, 5 by 7½ inches, 110 pages. Price, $4.75.

Written for the business or lay-man, this book summarizes the author's experience with radioisotopes in industrial applications and reviews their elementary characteristics. Mr. Jefferson is leader of the Technological Irradiation Group, Isotope Division, Atomic Energy Research Establishment, Harwell, Berkshire, England.

Part I examines the use of radioactive tracers and markers, such as cobalt-60, for rapid location of obstructions in pipe lines, pneumatic tube delivery systems, etc. In the first case, where leaks in piping systems or buried objects must be found, source-strengths up to 200 millicures are used. Objects stuck in pneumatic tube delivery systems can be located by attaching a 15-microcurie source to each carrier. This level of radiation is not dangerous and requires no special shielding except at the carrier storage point where total radiation might reach a dangerous level.

Leaks in water mains and tanks are found by the use of a small quantity of irradiated sodium bicarbonate. Added to the water, this material leaves a radioactive trail which can be traced to the leak-point with a sensitive detector. The radioactive count in this case is so small that there is no danger to the operator even if he becomes drenched with the solution.

An interesting method of finding leaks in nitrogen-pressurized electric mains utilizes a radon, a gas given off by radium. When a leak occurs in a cable, a small quantity of the gas is fed into the nitrogen which is being pumped to the leaking section of the main. As the radon decays, it turns into a radioactive solid material which can be traced.

Beta particles are used for thickness measurements of thin films and sheet materials, and gamma radiation is used for thicker products. The source and detection units can be so arranged that the radiation is transmitted completely through the material or backscattered. In either case, the radiation count (transmitted or reflected) is measured and calibrated in terms of material thickness.

X- and gamma-radiography are essentially the same, differing only in the type of source. X-rays are generated by bombarding a heavy metal target with a stream of electrons. Its strength is dependent upon, and can be controlled by, the impressed voltage. Gamma-radiation, however, cannot be controlled. The rays, which are produced by radioactive decay of atoms in the source, emanate in all directions. These have proved superior in making radiographs of heavy or dense objects.

Static electricity, generated during industrial processes, is removed by beta particles which are discharged across the material. These particles cause the air to ionize, thus permitting it to conduct the charge to ground.

Part II is devoted to an explanation of the fundamentals of radioactivity. Atomic structure is discussed and such things as exponential decay, nuclear charges, atomic pile operation, and production of radioisotopes are outlined. Detection apparatus including the Geiger counter, ionization chamber, scintillation detector, the cloud chamber, as well as photographic emulsion recording are explained.

"Fundamentals of High Polymers." O. A. Battista. Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y. Cloth, 6 by 9¼ inches. 140 pages.

Intended as an introductory text on the undergraduate level, this work covers the basic principles of high polymers as well as the formation of products from macromolecules.

Following a chapter on terms and definitions, the author outlines the basic chemistry of all of the major natural and man-made high polymer materials. Particular attention is given to polymers of the natural carbohydrate, polypeptide, condensation, addition, stereoregular, network, and inorganic types.

The second part, which deals with the formation of macromolecular products, develops the theory of crystallite structure where several molecules band together to form ordered nuclei. Architecture and geometry of macromolecules is explained, and several methods for measuring their chain length or molecular weight are described. Crystallite size and orientation are discussed in a section devoted to solid state conditions and, in conclusion, four major physical properties which are intimately tied to internal fiber structure are examined. A bibliography, for further investigation, is included.

"A Guide To Plastics." C. A. Redfarn. Philosophical Library, Inc., 15 East 40th St., New York 16, N.Y. Cloth, 5½ by 8½ inches. 150 pages. Price, $7.50.

Perhaps the most interesting feature of this book is the lack of chemical formulas, and the inclusion of 17 colored flow charts which, starting with the raw material, show the various stages in the manufacture of the main plastics materials. Specially prepared line drawings show the operation of various types of equipment used in forming.

The author gives a fairly comprehensive picture of the entire field, and describes in detail the basic and intermediate raw materials used in manufacturing the different plastics materials. Fabricating processes also are described. This book concludes with a list of plastics standards which have been defined by the British Standards Institution. A selected bibliography is included for those who wish to pursue specific subjects further.

"Effects of Space Charge in Polymeric Materials on Mechanical and Adhesive Properties." S. M. Skinner, E. L. Kern, and M. K. Park, Case Institute of Technology for Wright Air Development Center, U. S. Air Force. Order PB 131770 from OTS, U.S. Department of Commerce, Washington 25, D.C. Paper, 132 pages. Price, $2.75.

This research examined the effects which may be anticipated or measured resulting from the presence of space charge on polymeric materials. The work emphasizes those areas where experimentation might prove productive. One conclusion is that the charge exists in the vicinity of interfaces with chemically different materials. Among other results of this investigation, it was found that the space charge causes definite changes in electrical and mechanical properties; and that enormous modifications in adhesive strength can be obtained by different surface treatments.

Abstracts of Important Articles

Materials

"The Formulation of PVC Compositions for Resistance to Intense Gamma Radiation", H. Wells and I. Williamson, *Brit. Plastics*, 31, 7, 310 (July 1958).

At the Atomic Energy Research Establishment, Harwell, investigations were started to determine the behavior of elastomeric materials exposed to intense gamma radiation and frequent decontamination procedures. A first series of experiments carried out on plasticized PVC showed marked differences in behavior of the material depending on the plasticizer employed. PVC plasticized with triallyl phosphate showing least physical deterioration from the radiations; Reoplex 100 and 110 came next.

"Polyvinyl Acetal Resin", A. Camerini and L. Luchetti, *Materie Plastiche*, 24, 1, 33 (Jan. 1958).

After describing the preparation and physical and chemical properties of polyvinyl acetals, the authors examine the authors examine the possibility of using such resins for the interlayer in safety glass. They note best results were obtained with a polyvinyl butyral of 25,000 molecular weight which was composed of 0-2% polyvinyl acetate, 18-20% polyvinyl alcohol and 82-78% polyvinyl butyral. (In Italian.)

"Properties of Foamed Cold-Setting Urea Formaldehyde Resins. Part II", H. Baumann, *Kunststoffe*, 48, 9, 406 (Sept. 1958).

In this second part of his article, the author discusses tests on flammability and sound-insulating capacity of foamed cold-setting urea formaldehyde resins (Iso Foam). He also describes the behavior of such foams when compounded with lead, and lead or cadmium compounds, and exposed to soft (alpha, beta and neutron) and hard (gamma rays of cobalt) radiations. (In German.)

"New Plastics", H. A. K. Eden, *Plastica*, 11, 2, 122; 11, 3, 188 (Feb. & March 1958).

A description of the structure and properties of polycarbonate, polypropylene, Delrin, and Penton is preceded by a discussion of two directions in high polymer research that have become very important in recent years and played a leading role in the development of these new plastics: (1). the effort to control spatial macro-molecular arrangement; and (2). the realization that the mechanical behavior of a plastic can be properly established only by a spatial figure having time, temperature, and a mechanical property as co-ordinates. Physical aspects are treated in some detail, special reference being made to the non-destructive dynamic methods of testing properties evolved by Dr. K. Wolf and collaborators. In view of the ever-decreasing time-lapse between the development and initial application of a new plastic, the need is stressed for supplementing classical testing methods by others giving a more direct insight into the mechanical character of a material. (In Dutch.)

"Treating PVC with Plasticizers derived from Aliphatic Acids with C6 to C9", I. Bercovith and E. Paltin, *Ind. Plastiques Mod.*, 10, 7, 41; 10, 8, 54 (July-Aug. & Sept.-Oct. 1958).

The authors report on work carried out at the Chemical Research Institute of Bucharest on the synthesis of plasticizers for PVC derived from a mixture of aliphatic acids containing C6-C9 acids (caproic, enanthic, caprylic and pelargonic). The physico-chemical properties of the glycol ester, triglyceride, diglyceride and diesterethylene glycol of these acids, both alone and mixed with 50% dibutylphthalate, were tested for compatibility in PVC compounds. Other tests were aimed at developing optical formulas for current consumer and other goods, and at determining the plasticizer mechanism. Mechanical and electrical properties of mixes with the new plasticizers were compared with those made with the classic plasticizers, and the superiority of two of the former appeared. (In French.)

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in June. The last listing appeared in the February issue.

"Graft Polymerization", P. Piganiol, *Kunststoffe*, 48, 9, 398 (Sept. 1958).

A review of the most important chemical and radiation techniques used in producing graft polymers is followed by a discussion of the possibilities for application from the standpoints of influencing materials in the mass (improving mechanical properties, changing solubility, increasing the range of polymers mixable with PVC), or influencing the surface of a material only (making it anti-static, changing adhesion properties, and improving the action of textile finishes and dyes). The economics of the methods also are briefly considered. (In German.)

"High-Polymer Materials. Part 3. States and Transition Phases", O. Leuchs, *Kunststoffe*, 48, 8, 365 (Aug. 1958).

The relation between the softening of high polymers as temperature increases and the principal properties of the molecules are described in discussions of the successive states of hard elastic, second-order transition, soft elastic, crystallization, flow zone, plastic state, and decomposition. It is shown that the different states and transition zones of high polymer materials are to be ascribed essentially to molecular configuration and intermolecular forces. In the case of thermoplastics only, a third factor is studied (the length of the thread-like molecule), in order to explain flow and plastic phenomena. Low molecular materials are referred to for comparison (In German.)

"Determining the Solid Contents of Aminoplastic Glues for Practical Use," W. Reissmann, *Plaste u. Kautschuk*, 4, 11, 418 (Nov. 1957).

The existing method of determining the solid content of aminoplastic glues for use in the wood-working industry is examined, and a special improved method is described with which reproducible results (with an error of only about 1%) can be obtained within 30 minutes. In this, use is made of a Zeiss refractometer, as designed for the sugar industry, and a formamide solvent. (In German.)

"Tensile and Impact Strength of High Polymers in Relation to Temperature," W. Spath, *Gummi u. Asbest*, 11, 1, 24 (Jan. 1958).

Static tensile tests on high polymers carried out at various temperatures yielded data on the relation of load at break to temperature from which a bell-shaped curve was derived. It was thought that such a curve would be found also for the impact test. This conclusion was partly confirmed by two new series of tests. It was shown that impact strength, as determined by the impact test, cannot give a clear picture of the state of a material. (In German.)

"Contributions to the Analytical Chemistry of Plastics. VII," K. Thinius E. Schroeder and U. Waurick, *Plaste u. Kautschuk*, 4, 11, 409 (Nov. 1957).

Proposals for two I.S.O. Standards are examined critically: ISO T. G. 61 Plastics W.G. 6/13 "Determination of the Volatilization of Plasticizers out of Plastics Compounds"; and ISO T. G. Plastics W. G. 15 (Italy 3) "Standard Method of Determining Vinyl acetate in Vinyl chloride/Vinylacetate Copolymers." With regard to the first, exception is taken to the method of embedding the sample film directly in active carbon. The second method is found unsuitable for use as standard testing method and an alternate method is described. (In German.)

"Determination of the Water Absorption of Foamed Materials," O. Wehring, *Plaste u. Kautschuk*, 4, 11, 414 (Nov. 1957).

No standards for determining water absorption of cellular materials had been fixed officially. The problems encountered by the author in work in this direction, undertaken in response to requests from ship builders and fisheries, forecast the difficulties that will have to be overcome in working out standard specifications. Consequently, it was decided to publish the above report on the evaluation of findings resulting from investigations on rigid and plasticized PVC foamed materials, known as Ekazell, as a contribution towards standardization. (In German.)

"Irradiation Improves Polyethylene-Coated Cables," L. Walter, *Canad. Plastics*, p. 39 (Jan. 1958).

The results of a series of tests on two types of tinned copper wire insulated with irradiated polyethylene are discussed. Electrical properties show little change; the value of Young's modulus increases linearly with increasing irradiation dose; ultimate tensile strength at elevated temperature is improved; and so is resistance to deformation.

"The Use of Fillers in Polyester Reins. Special Case of Thodesters," M. Tourniaire, *Ind. Plastiques Mod.*, 10, 7, 18 (July-Aug. 1958).

The polyester studied was Thodester 1108, and the effects of the type and proportion of filler, as well as particle size, were examined for viscosity, impact, and flex resistance. The fillers included asbestos, calcium carbonates, dolomites, mica, labrodorite, barium sulfate, silica, talcum, wollastonite, mineral wool, alfa foam, and, for comparison, glass mat. Some of the fine fillers as Aerosil coated with stearic acid and Vercoryl rendered the resins thixotropic. (In French.)

"Steriospecific Catalysts and Stereisomeric Polymers", G. Natta, *Mat. Plastiche*, 24, 1, 3 (Jan. 1958).

At the 16th International Congress of Pure and Applied Chemistry, held in Paris in July 1957, Prof. G. Natta delivered the opening lecture. He discussed the preparation by the new methods, of new plastics, new fibers and new elastomers, also their properties. A bibliography includes 50 references. (In Italian.)

Equipment

"Techniques and Equipment for Extrusion," *Brit. Plastics*, 31, 7, 268 (July 1958).

This is a special section of four articles devoted to extrusion machines. In the first, "Extrusion—a Contemporary Assessment," A. Kennaway surveys the paths along which extrusion is now developing, and attempts to predict future progress. In "The Engineering of Extrusion," E. A. O. Mange compares single- and twin-screw extruders, and deals more specifically with the production line for tube fabrication and the factors that can affect efficient operation. "Some Aspects of Extrusion Die Design," by E. G. Fisher and W. A. Maslen, begins with a justification of the use of Newtonian flow expressions. Some of the problems connected with the flow of plastics through tube and profile dies are examined, and some solutions are offered. Extrusion die and screw restriction systems are treated in some detail, new trends are considered, and the need shown for designing dies in conjunction with the screw and restrictor system. The last section, "Extrusion Equipment of the World," presents 54 machines by manufacturers in Australia, Europe, Japan, and America.

"Injection Molding of Screw Closures," H. Gastrow, *Kunststoffe*, 48, 8, 389 (Aug. 1958).

A 16-cavity mold is described that was designed for central injection inside a tube closure whereby, it is claimed, weld marks and gate marks on the finished article are avoided. (In German.)

"Interchangeable Parts in the Construction of Extrusion Equipment", F. P. Karger, *Brit. Plastics*, 31, 8, 338 (Aug. 1958).

To meet new processing demands, extruders and auxiliary equipment should be designed to permit exchange or addition of assembled units and be simple in upkeep. The author, who is chief engineer of Reifenhauser A. G,. the German manufacturers of an enclosed, compact-type extruder, discusses the requirements for the main parts of extruders and their accessory equipment.

"Saturable Core Reactor Temperature Controls," George Northrop, *SPE J.*, 15, 2, 137 (Feb. 1959).

Tests show that core reactor temperature controllers proved less temperature variations than those encountered with on-off time proportioning controllers.

"A New Approach to the Heating Cylinder Problem," A. R. Morse, *Plastics Ind.*, 17, 2, 16 (Feb. 1959).

This SPE Antec paper gives a complete discussion of heating cylinders and their uses in injection molding.

Processing

"Molding and Forming the New Polyolefins," R. D. Hanna and J. Y. Lomax, *Modern Plastics*, 36, 6, 111 (Feb. 1959).

Methods for molding and forming polypropylene are discussed and compared with those for high-density polyethylene.

"Effect of Low-M. W. Polyethylene Waxes on PE Injection Moldings," K. A. Kaufmann and C. S. Imig, *Modern Plastics*, 36, 6, 137 (Feb. 1959).

Both advantages and disadvantages of the waxes for injection molding of polyethylene are discussed in detail.

"How to Reduce Carbonization in the Injection Cylinder," C. S. Imig, *SPE J.*, 15, 2, 142 (Feb. 1959).

Several preventive steps are given for preventing carbonization.

"Contribution to the Dielectric Determination of the Degree of Cure in Phenolic Resin Molding Compounds," T. Gast and G. Gramberg, *Gummi u. Asbest*, 10, 11, 618 (Nov. 1957).

The purpose of the work discussed in this article was to decide whether dielec-

tric measurements offered a suitable non-destructive means of determining the degree of cure in phenolic resins moldings. After an introductory explanation of the theories involved, measurements of the dielectric constants and loss factor, at temperatures from —50 to + 60° C., on four different phenolic moldings are described, as well as specific conductivities in the same temperature range. Curves obtained for cured resins were flatter than for the uncured samples. It appears that in a few instances, under selected conditions, quantitative determination of cure might be possible by this method. (In German.)

"Shrinkage and Post-Shrinkage of Molding Materials", H. Teipelke, *Kunststoffe*, 48, 8, 395 (Aug. 1958).

The terms "shrinkage" and "post-shrinkage" are defined. Tests are described for determining both values for a number of samples. (In German.)

"Relation between Injection Molding Conditions and Tensile Strength of Standard Polyethylene," J. Delombre and L. Garnier, *Ind. Plastiques Mod.*, 10, 7, 36 (July-Aug. 1958).

The studies described in detail refer to high-pressure polyethylene injection molded at temperatures from 110-250° C. with optimal pressure and cycling. Tensile tests were carried out on longitudinal samples and transversely-cut samples. Results confirm previous assumptions on the orientation of the material during injection and its behavior during the tests. (In French.)

"Induction Heating in Processing Plastics", P. Drapier, *Ind. Plastiques Mod.*, 10, 8, 30 (Sept.-Oct. 1958).

The advantages of induction over resistance heating in extruding, and for injection, compression and transfer molding are explained. Mention is made of recent American and British equipment using induction heating. (In French.)

"Adhering Rigid PVC", R. Dubos, *Plastiques Informations*, No. 180, p. 7; No. 180, pg. 5 (May 1, 1958; May 16, 1958).

Adhesion techniques may be employed successfully to solve certain problems in bonding rigid PVC parts for which welding is not quite satisfactory. This is demonstrated by examples of methods used in connecting elbow pipe and the like in plumbing, and for lining and cladding in boiler work. (In French.)

"Welding Metal Plate/PVC Laminates", M. Doucet, *Plastica*, 11, 3, 178 (March 1958). Ordinary spot-welding methods cannot be used for the laminated metal-PVC sheet material known as Skinplate in Europe, and as Marvibond in the United States. The special method employing "dent" welding and welding time of 1/100 second, regulated by electronic means, which has been developed in Belgium for this purpose, is described. (In Dutch.)

"Vacuum-forming and its Applications", R. W. Harwood, *Plastics (London)*, 23, 250, 248 (July, 1958).

Description in general terms of the different methods of vacuum forming and finishing operations, the materials that may be used, and applications in packaging, advertising, industry, and the home.

"Abrasive Papers and Cloths in Plastics Processing", H. Goldschmidt, *Kunststoffe*, 48, 8, 393 (Aug. 1958).

Hints on the use of abrasive papers and cloths in the finishing of plastics are given, it being noted that wet processes are used for thermoplastics and dry methods for thermosets. Equipment for both procedures is described. (In German.)

Applications

"Plastics in the Cheese Industry", M. Simonich, *Poliplasti*, 6, 25, 17 (Jan.-Feb. 1958).

The advantages of using plastic parts in the cheese-making industry include resistance to acids, hygiene, ease of installation, durability, and price. The main applications are in tubing (flexible pipe of polyethylene and rigid PVC pipe), pans, and vats. Special consideration is given rigid PVC pipe, the use of which is illustrated by a description of the various methods of treating the milk for cheese-making. (In Italian.)

"The Use of Rilsan Film in Agriculture", J. Soyeur, *Ind. Plastiques Mod.*, 10, 8, 13 (Sept.-Oct. 1958).

Experiments carried out in Belgium and France indicate that transparent Rilsan can be used for frames and greenhouses in market gardening under the same conditions as glass. It offers economical advantages through its low density (lower labor costs because it is easier to handle) and ability to withstand the impact of heavy winds and hail, and the weight of accumulations of snow. (In French.)

"Plastic Boats", J. O. W. van Dugteren, *Plastica*, 11, 3, 182 (March 1958).

Description of various types of plastic boats exhibited by 15 Dutch firms at the 1958 Exhibition of Water Sports held in Amsterdam. (In Dutch.)

"Plastics in the Laboratory. Part 4", G. Haim, *Plastics (London)*, 23, 249, 233 (June 1958).

This is the last installment of a series of articles started in March 1958 on the use of plastics in the laboratory, in which were described applications including funnels, jars, test tubes, trays, bottles, jet pumps, fans, jugs, fume ducts, tubes and piping for numerous purposes, washers, covers, etc.

"Expanded Cellular Polystyrene and its Great Possibilities", J. Coves, *Rev. Plasticos*, 9, 50, 82 (March-April 1958).

Methods and molds for preparing these materials are reviewed, as well as their thermal and electrical properties. Applications for thermal insulation, in sandwich structure, toys, novelties, packaging for fragile articles, etc., are described. (In Spanish.)

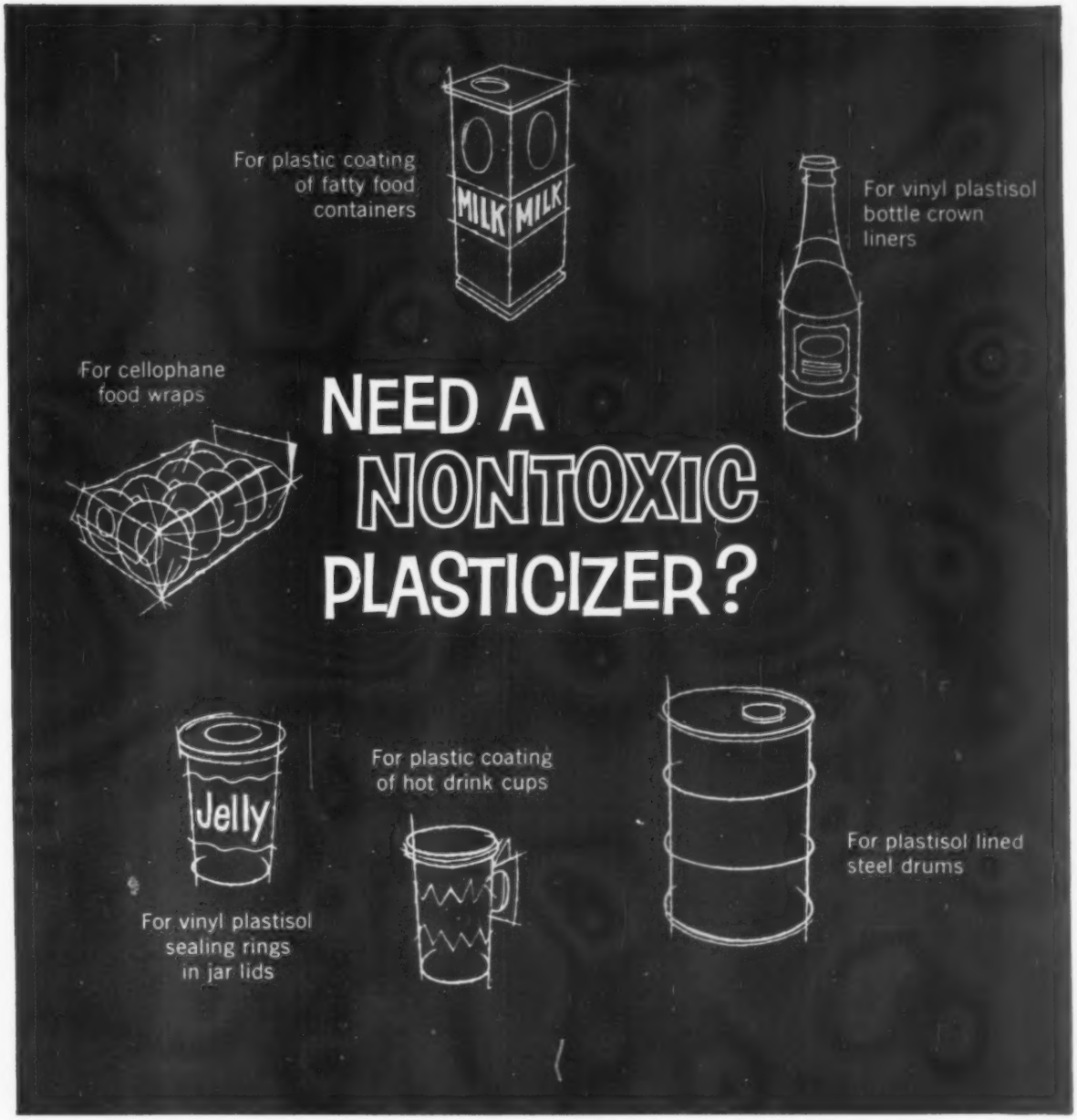
General

"The Plastics Industry, Institute and Press", C. W. Welch, *Trans. Plastics Inst.*, 26, 64, 101 (April 1958).

This was a lecture by C. W. Welch, assistant editor of "Plastics" and Chairman of the London and District Section of The Plastics Institute, given December 17, 1957. The speaker reviewed the history of the plastics industry, the Plastics Institute, and the technical press devoted to plastics. He made a point of the considerable influence that professional organizations and trade papers had on the growth of the plastics industry.

"Plastics in 1958", G. Moretti, *Mat. Plastiche*, 23, 12, 951 (Dec. 1957).

The developments in the plastics industry in America and the chief West European countries, also in East Germany, are reviewed. The trends in production, consumption, and application of phenolics, aminoplastic resins, polyethylene, polystyrene, vinyls, cellulosics, polyesters, and acrylics all are considered. A table showing world production of the principal plastics materials from 1950 to 1956 inclusive, and another comparing Italian imports and exports of plastics in 1956, are included. (In Italian.)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Patent Digest

Materials

Process for the Production of Polymerization Products. No. 2,846,418. Helmut Bredereck, Stuttgart, and Erich Bader, Hanau (Main), Germany. (to W. C. Heraeus G.m.b.H., Hanau (Main), and Deutsche Goldund Silber-Scheideanstalt vormals Roessler, Frankfurt-am-Main, Germany).

Bulk polymerization of a vinyl compound which has a terminal double bond linked to a methylene group is effected in the presence of a salt of an organic amine and a member selected from the group consisting of alkali and alkaline earth salts of a sulfinic acid.

Plasticizers. No. 2,844,483. Frederick E. King, London, England. (to British Celanese, Ltd., London, England).

This composition has a basis of cellulose acetate plasticized with an ester selected from the class consisting of the penta-acetate of 2:2:6:6-tetramethylol cyclohexanol and its nuclear monomethyl substitution derivatives.

Method of Repairing Thermoplastic Dies. No. 2,842,801. George J. Walkey, Burbank, and Clifton P. McGregor, North Hollywood, Calif. (to Lockheed Aircraft Corp., Burbank, Calif.)

The female portion of the die is repaired by setting it up in a retainer, and pouring in a quantity of liquid plastic of the same materal out of which the die is made. A male die assembly is moved to a mating position and allowed to exert a constant downward pressure. The two assemblies are heated to the lowest limit of the thermoplastic material's melting point range. Pressure and temperature are maintained until the entire female die is in a semi-liquid condition. The male die assembly then is removed, and the female die is air-cooled.

Manufacture of Modified Polyethylene Alcohol Telomer and Oxidized Polyethylene Alcohol Telomer Waxes. No. 2,845,413. Allen C. Goodrich, East Aurora, and Thomas R. Liston, Hamburg, N.Y. (to Allied Chemical Corp., New York, N.Y.).

These waxes are improved by the addition of about 1-15% by weight of an organic polyisocyanate which has a hydrocarbon group containing not more than 16 carbon atoms. The mixture is heated to a temperature between 100-300° C., to effect a reaction between the polyisocyanate and the wax.

Internally Plasticized Polymers of Vinyl Chloride. No. 2,845,404. Harold K. Garner, Packanack Lake, Hubert F. Jordan, and Wendell V. Smith, Nutley, N.J. (to United States Rubber Co., New York, N.Y.).

This thermoplastic, resinous terpolymer consists of 50-95% vinyl chloride with the balance of the mixture being made up of a vinyl ester and dialkyl maleate in a ratio of 15:1 to 1:15. The vinyl ester is derived from a saturated, aliphatic, monocarboxylic acid having from 8-18 carbon atoms per molecule. The dialkyl maleate has from 7-18 carbon atoms in each alkyl group.

Process for the Production of Polymeric Amines and Ammonium Salts From Olefin-Carbon Monoxide Polymers. No. 2,846,406. Helmut Kleiner, Opladen, Otto Bayer, Leverkusen-Bayerwerk, and Hugo Wilms, Leverkusen, Germany. (to Farbenfabriken Bayer, A.G., Leverkusen, Germany).

Monoolefine-carbon monoxide copolymers are contacted with formaldehyde, and salts of a compound selected from the group consisting of ammonia, primary, and secondary amines at a temperature of at least 50° C.

Process for Improving Polymers of Acrylonitrile. No. 2,846,423. Adolf Hartmann, Gessertshausen, Germany. (to Farbwerke Hoechst, A.G., Frankfurt-am-Main, Germany).

Thermal stability of a solid copolymer of acrylonitrile containing basic nitrogen groups is improved by contacting it with an aqueous soluton of hydrofluoboric acid and its water-soluble salts at an elevated temperature.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Prices, 25c each.

—The Editor

Dispersions of Solids in Caprolactam and Process of Making Them. No. 2,846,332. Glen A. Nesty, Morristown, N.Y. (to Allied Chemical Corp., New York, N.Y.).

Five parts by weight of finely divided pigments, fillers, and delustrants are dispersed in 100 parts by weight of caprolactam, with substantially no particle agglomerates of diameter greater than about 10 microns.

High Luster Polyamide Filaments and Process For Producing Them. No. 2,846,289. John Gray, Welwyn Garden City, England. (to Imperial Chemical Industries, Ltd., London, England).

Molten synthetic linear polyamide is extruded ito a bath which has substantially no solvent action on the polymer and which is maintained at —5° C.

Copolymerized and Cross-Linked Epoxide Resins. No. 2,848,433. Frederick R. Eirich, Tuckahoe, N. Y. (to Aries Laboratories, Inc., New York, N. Y.).

One hundred parts by weight of a resinous polyepoxide produced by reacting a polyhydric phenol with an epihalohydrin, 20-40 parts of a polycarboxylic acid anhydride containing an ethylenic unsaturation, and from 8-12 parts of an ethylenically-unsaturated monomer copolymerizable with the anhydride, are blended to form a thermosetting resin composition.

Preparation of Phenolic Resins. No. 2,843,436. Roger M. Christenson, Whitefish Bay, Wis. (to Pittsburgh Plate Glass Co., Pittsburgh, Pa.).

A mixture of alkenylphenols and formaldehyde are condensed in the presence of an alkaline catalyst and a water soluble alkali metal hydrosulfite to obtain an oil soluble, light colored, phenolic resin capable of forming fast curing, light colored films.

Amine-Formaldehyde Resins. No. 2,848,438. Earl W. Gluesenkamp, Dayton, O. (to Monsanto Chemical Co., St. Louis, Mo.).

These are monomeric condensation products of HCN tetramer and at least one mole formaldehyde per mole HCN-tetramer.

Purification of Maleic Anhydride. No. 2,848,460. Howard D. Cummings, St. Louis, Mo. (to Monsanto Chemical Co., St. Louis, Mo.)

Crude maleic anhydride is heated in the presence of fumaric acid at a temperature greater than 130° C.

Vinylene Carbonate-Ethylene Copolymer and Method of Producing Same. No. 2,847,398. Earl W. Gluesenkamp and John D. Calfee, Dayton, O. (to Monsanto Chemical Co., St. Louis, Mo.).

A major proportion of ethylene and a minor proportion of vinylene carbonate are copolymerized at a minimum pressure of 15,000 psi., and a temperature between 50-100° C.

Ethoxyline Resin Compositions and Their Preparation. No. 2,847,341. Leo S. Cohn, Schenectady, N.Y. (to General Electric Co., Schenectady, N.Y.).

This composition is a heat-reaction product of 100 parts by weight of a complex epoxide resin; three to 20 parts by weight of lactam; and two to 10 parts by weight of organic titanium ester.

Production of Acrylonitrile. No 2,-847,447. Thomas R. Steadman, Waban, and James F. Gabbett, Jr., Weymouth, Mass. (to Escambia Chemical Corp., Pace, Fla.)

Acetylene and vapor-phase hydrogen cyanide, together with an inert catalyst, are reacted in a kettle whose inner surface consists of an alloy of iron and aluminum.

Nylon-Carbon Black Composition and Article. No. 2,849,414. Louis L. Stott, Wyomissing, Pa. (to Polymer Corp., Reading, Pa.)

This composition has a low-fill ratio and consists of finely-divided linear polyamide and carbon black.

Amine-Epoxide Adhesive Composition Containing Thiuram Sulfide and Process of Making Same. No. 2,849,417. Tung Tsang, Minneapolis, Minn. (to Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.).

This adhesive consists of an epoxy base resin, a diamine catalyst, a tetra-sulfide, and a titanium dioxide filler.

Unsaturated Aminosilanes, Polymers Thereof and Methods of Making Them. No. 2,847,409. Peter L. de Benneville, Philadelphia, and Marvin J. Hurwitz, Elkins Park, Pa. (to Rohm & Haas Co., Philadelphia, Pa.)

This composition comprises an addition copolymer of methyl methacrylate with N-trimethylsilyl - N - methyl - 2-aminoethyl vinyl ether.

Polyvinyl Chloride Composition and Process for Wetspinning Same. No. 2,847,271. Francesco Siclari and Angelo Bellano, Cesano Moderno, Italy (to Snia Viscosa Societa Nazionale Industria Applicazioni Viscosa, Milan, Italy).

These spinnable solutions consist of PVC dissolved in methyltetrahydrofurfurylamine.

Vapor-Phase Polymerization of Tetrafluoroethylene in the Presence of Fillers. No. 2,847,391. Ahlborn Wheeler, Arden, Del. (to E. I. du Pont de Nemours and Co., Wilmington, Del.).

Approximately 20% by weight of hydrated silica is heated to at least 400° C., and cooled to below 150° in the absence of water. It is mixed with tetrafluoroethylene within the temperature range between —20 and 150° C., to cause polymerization.

Equipment

Machine for Mixing and Extruding Plastics and the Like. No. 2,845,656. Ernesto Gabbrielli, Milan, Italy.

Two circular wall-forming members, one of which rotates within the other, define an elongated channel through which the material is moved and mixed. At a certain point a scraper, which rides against the rotaing member, diverts the plastic into a compression chamber leading to a restricted extrusion passage.

Processing

Production of Polymeric Alpha-Chloroacrylate Sheets. No. 2,848,753. Harry D. Anspon, Easton, and Frank Pschorr, Phoenixville, Pa. (to General Aniline & Film Corp., New York, N.Y.).

Alpha-Chloroacrylic acid ester monomer is poured into a casting cell which is supported in an inclined position. The upper cell wall is relatively thin and flexible and is forced into parallel relationship with the lower wall by a flat rigid member having similar surface dimensions. The opening is sealed when the level of the monomer is immediately adjacent to it.

Tube Extrusion. No. 2,848,747. Glenn R. Dixon, Hamden, Conn. (to Olin Mathieson Chemical Corp., New Haven, Conn.).

A cellulose film-forming solution is cast upon a newly extruded thermoplastic tube. The composite tube and cast film are expanded, and the residual heat in the extrusion is used to dry the film. After drying, the cellulose film is slit and stripped from the tube.

Aqueous Dispersions of Polymers and Shaped Articles Therefrom, No. 2,846,727. Max F. Bechtold, Kennett Square, Pa. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Discrete particles, less than 15 microns in diameter, are dispersed in an aqueous solution containing a solvent metal salt for the polymer. The salt is present in an amount at least one-half the weight of the polymer, but should be insufficient to form a solution which would dissolve it. The dispersion is formed to the desired shape, water is evaporated until coalescence occurs, and the salt is washed from the article.

Method of Producing Artificial Sponges. No. 2,842,799. Alfred Politzer, Cleveland, O.

A fluid mixture of viscose, reinforcing fibers, and a pore forming material are extruded in a ribbon which is deposited in layers that are in intimate interfacial contact. Coagulaton of the viscose is effected to form an integral body of sponge material which is sliced along a plane parallel to the faces of the integrated ribbons.

Production of Vinyl Compounds. No. 2,843,576. James H. Dunn and Percy W. Trotter, Baton Rouge, La. (to Ethyl Corp., New York, N.Y.).

The vinyl compounds are polymerized in an aqueous system which contains a water insoluble catalyst, and from 4-8% by weight of an emulsifying agent.

Process for Continuous Drying, Washing, and Cutting of Vinyl Sheeting. No. 2,842,800. Carl K. Cochran, New Kensington, Pa. (to Pittsburgh Plate Glass Co., Pittsburgh, Pa.).

A web of vinyl material is fed through a drying zone where moisture and traces of volatile material are removed. It is cooled and washed in a warm bath of softened water to remove chemical deposits; rinsed in cold, softened, water; and stripped of liquid. Heat again is applied to the web to anneal it and remove residual moisture. Air blasts straighten the web just before it moves into a cold zone, where it is chilled and set.

RCI EPOTUF Epoxy Resin

"An ideal resin for potting applications"

says J. R. McRobert, vice president, Novi Equipment Company

Engine heat, vibration and road shocks present problems that must be met and mastered in auto air conditioning equipment. And the Novi Equipment Company, Novi, Michigan, has found that an RCI EPOTUF epoxy resin plays a vital role in the manufacture of its air conditioners — successfully seals a copper coil component in the steel magnetic compressor clutch — insuring dependable performance.

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Applications

Snag Resistant Bulky Multi-Ply Superpolyamidic Yarn. No. 2,846,839. Jacques Billion, Lyon, France (to Societe Billion & Cie., Lyon, France).

Components of the yarn comprise a plurality of bundles of superpolyamidic filaments. The bundles are held together by a twist having between 400 and 800 turns per meter. Fibers within each bundle have kinky undulations and extend parallel to each other within the bundle.

Plastic Label Holder With Attaching Means. No. 2,846,795. Philip Balaban, Detroit, Mich. (to Office Products, Inc., Detroit, Mich.).

A rectangular frame of plastic material has a central opening which forms a window for a label. Along opposite side edges, longitudinally-directed slots receive a securing means for holding the label holder to an element.

Striated Plastic. No. 2,848,749. Abraham Joel Tobias, Rego Park, N.Y.

A heated, cast methyl methacrylate sheet is stretched and permitted to cool while stretching so that it forms a permanent set. The sheet is scored with a band-saw and heated about its edges so that a plurality of striations are formed. These striations extend in the direction of the stretching.

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1 time	$19.00 per inch
6 times	$18.00 per inch
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Can be used as sole Plasticizer

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100% Modulus	1320 psi
Tensile Strength	2695 psi
Elongation	338%
Hardness, Shore A	80
T_f	−17.3°C.
Flux Time	45 seconds

heat stability (180°C.)

Initial Discoloration	15 min.
Maximum Discoloration	90 min.

extraction loss

Water	0.21 %
1% Soap	3.45 %
Mineral Oil	2.10 %

migration

Lacquer, 25°C., 14 days	Very slight softening
Varnish, 25°C., 14 days	No effect
Polystyrene, 60°C., 19 days	No effect

HARCHEM produces a full line of phthalate, adipate, sebacate and polymeric plasticizers. The Harchem Division laboratories will gladly assist you with your plasticizer problems, or will supply additional data including formulation test methods and formulation suggestions for any Harflex Plasticizer.

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In Brief . . .

Dow Chemical Co. has announced the formation of an overseas subsidiary in Venezuela—Dow Chemical International, Ltd., S. A. Leland I. Doan, president of the parent company, has been elected chairman of the board; Clayton S. Shoemaker becomes president of the subsidiary. Offices have been opened in Caracas, with Robert F. Kincaid as manager.

CALENDAR of COMING EVENTS

April 28

SPE North Texas Section RETEC. A Designer's Look At Reinforced Plastics From The Pleasure Boat, Aircraft, and Missiles Industries Viewpoint. Adolphus Hotel, Dallas, Tex.

April 29-30

Manufacturing Chemists' Association, Inc. Packaging and Transportation of Chemical Products. Engineering and Scientific Center, Cleveland, O.

April 29-May 3

ASME Metals Engineering Div. Conference. Sheraton-Ten Eyck Hotel, Albany, N.Y.

May 5-22

Tokyo International Trade Fair. Plastics Hall, Tokyo, Japan.

May 7

SPE Pittsburgh Section RETEC. Plastics and the Metals Industry. Penn-Sheraton Hotel, Pittsburgh, Pa.

May 22

SPE Northern Indiana Section RETEC. Plastics in Electrical Insulation. Fort Wayne, Ind.

June 17-27

International Plastics Exhibition. British Plastics. Olympia, London England.

June 19

SPE Detroit Section RETEC. Plastics in the Automotive Industry. Detroit, Mich.

August 9-12

ASME-AICE Heat Transfer Conference. University of Connecticut, Storrs, Conn.

September 10-11

ASME Wood Industries Conference. Multnomah, Portland, Ore.

October 7

SPE Cleveland Section RETEC. Vinyl Plastics. Cleveland, O.

October 16

SPE Buffalo Section RETEC. Plastics Finishing. Niagara Hotel, Niagara Falls, N.Y.

November 8-10

Toy Production Show (originally scheduled for April 14-16) New York Trade Show Building, New York, N.Y.

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- 30 molding cycles per minute*
- shut-off nozzle for pre-pressurized molding
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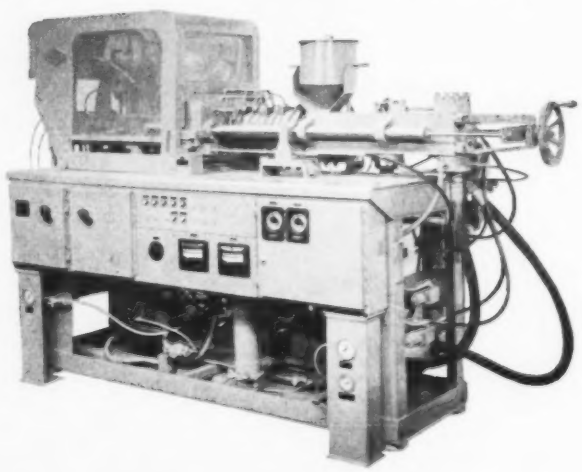

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Domestic Production and Sales of Plastics and Resin Material, November and December, 1958

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of October and November, 1958. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Production and sales figures for all materials, except celluloses which remained about the same, show slight to moderate increases over last year's totals. Phenolics have increased 17%; urea and melamine resins, 11%; styrenes, 11%; vinyls, 18%; coumarone indene, 2%; polyesters, 23%; miscellaneous, 25%; and grand totals, 20%.

	November, 1958		December, 1958	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,122,491	1,511,971	1,830,994	908,505
Sheets, 0.003 gage and over	1,637,495	1,676,177	1,609,677	1,528,625
All other sheets, rods, and tubes (including other cellulose plastics)	714,911	895,851	797,745	838,670
Molding and extrusion materials (including other cellulose plastics)	8,541,810	8,335,507	8,432,107	8,148,224
Nitrocellulose sheets, rods, and tubes	226,529	213,700	160,705	207,606
TOTALS	12,243,236	12,633,206	12,831,228	11,631,630
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	18,747,509	16,472,025	19,221,702	15,439,408
Bonding and adhesive resins for—				
Laminating (except plywood)	5,772,950	3,938,440	5,129,465	3,612,236
Coated and bonded abrasives	1,068,739	1,190,770	1,614,970	1,217,521
Friction materials (brake linings, clutch facings, and similar materials)[7]	1,490,599	1,279,537	1,472,038	1,462,032
Thermal insulation (fiber glass, rock wool)	3,943,550	4,002,638	3,954,709	3,928,772
Plywood	4,253,293	3,239,024	4,222,779	4,303,006
All other bonding and adhesive uses	5,029,502	4,317,828	5,108,935	4,927,769
Protective-coating resins unmodified and modified except by rosin	2,525,490	1,859,244	2,587,527	1,977,591
Resins for all other uses	3,480,226	2,963,269	3,570,790	2,979,213
TOTAL	45,311,858	39,262,775	46,837,915	39,847,548
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	3,348,390	2,881,772	3,353,947	2,690,808
Paper-treating and paper-coating resins	2,303,595	2,025,109	1,916,519	1,865,316
Bonding and adhesive resins for—				
Laminating	2,591,897	2,149,718	2,501,650	2,414,444
Plywood	9,395,682	8,995,583	10,044,111	10,272,713
All other bonding and adhesive uses	1,179,094	1,270,170	1,341,315	1,336,919
Protective-coating resins, straight and modified	2,849,974	2,156,211	2,887,031	2,350,687
Resins for all other uses, including molding	8,873,641	7,834,065	7,344,974	7,768,457
TOTAL	30,506,273	27,312,628	29,389,547	28,699,344
Styrene Resins:				
Molding materials[1]	48,155,731	39,490,892	46,813,777	43,060,931
Protective-coating resins, straight and modified	8,248,932	7,678,031	9,867,343	7,899,322
Resins for all other uses	14,404,743	10,734,296	14,188,872	11,007,266
TOTAL	70,809,406	57,903,219	70,869,992	61,967,519
Vinyl and Vinyl Chloride Resins:[4]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		5,760,289		5,953,821
Sheeting (resin content)		6,430,807		7,870,609
Molding and extrusion (resin content)		20,239,467		22,161,853
Textile and paper treating and coating (resin content)[8]		6,023,516		6,110,320
Flooring (resin content)		9,938,277		9,843,197
Protective coating (resin content)		2,134,308		1,995,973
All other uses (resin content)		7,227,416		9,375,995
All other vinyl resins for—				
Adhesives (resin content)		4,014,666		3,815,497
All other uses (resin content)		10,439,023		11,291,992
TOTAL	85,649,362	72,207,769	81,562,522	78,419,257
Coumarone-Indene and Petroleum Polymer Resins	19,635,338	18,850,853	18,818,263	17,895,810
Polyester Resins:				
For reinforced plastics	7,638,901	6,643,245	8,962,761	7,735,917
For all other uses	1,607,439	1,441,382	1,878,804	1,596,537
TOTAL	9,246,340	8,084,627	10,841,565	9,332,454
Polyethylene Resins:				
For film		27,628,548		36,593,985
For all other uses		44,542,333		51,119,308
TOTAL	78,665,600	72,170,881	83,691,988	87,713,293
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding Materials[1,4]	5,089,358	4,372,843	5,314,125	4,983,970
Protective-coating resins[5]	1,887,553	687,632	2,602,043	661,585
Resins for all other uses[6]	13,576,986	11,645,912	13,822,729	12,126,327
TOTAL	20,553,897	16,706,387	21,738,897	17,779,882
GRAND TOTALS	372,621,310	325,132,345	376,581,917	353,286,737

[1] Includes fillers, plasticizers, and extenders.
[2] Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3] Includes data for spreader and calendering-type resins.
[4] Includes data for acrylic, nylon, silicone, and other molding materials.
[5] Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7] Included with "All other bonding and adhesives uses."
SOURCE: United States Tariff Commission, Chemical Division.

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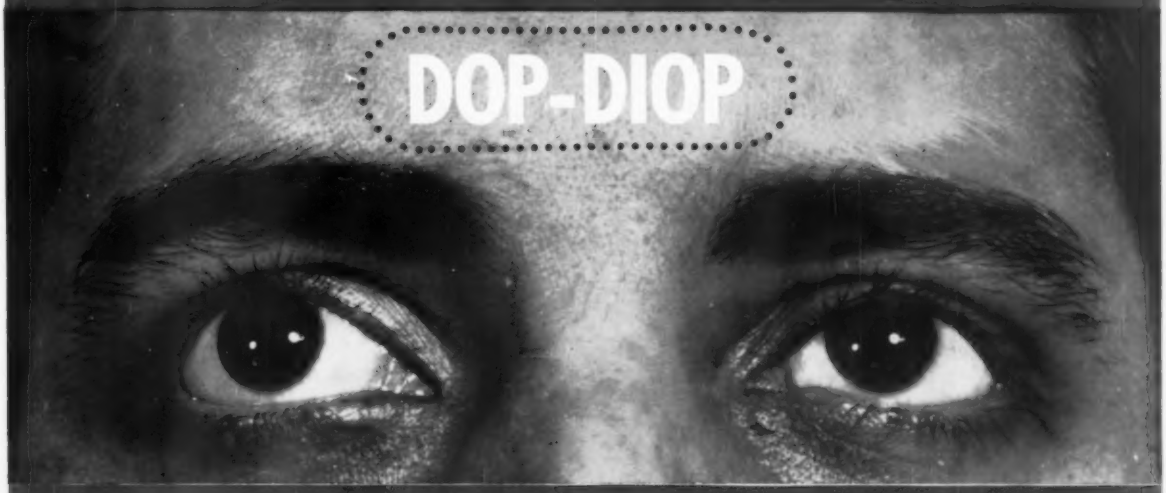
When you think of BASIC PHTHALATES . . .



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IF YOU make vinyls, you know the importance of dependable supplies of DOP and DIOP. That's why so many vinyl producers list PITTSBURGH COKE as their primary supplier of these products.

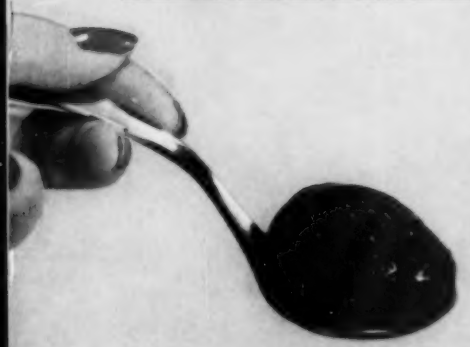
PITTSBURGH takes pride in its ability to provide uniform, top-quality products . . . delivered on schedule . . . and backed by complete technical service.

Today, and ten years from today, our one aim will be to provide you with **better plasticizers at lower cost.**

WSW 7408

COAL CHEMICALS • PLASTICIZERS • PROTECTIVE COATINGS • ACTIVATED CARBON • CEMENT • COKE • FERROMANGANESE • PIG IRON

NEW DESIGNS IN MARLEX



Boilproof MARLEX* prune jar

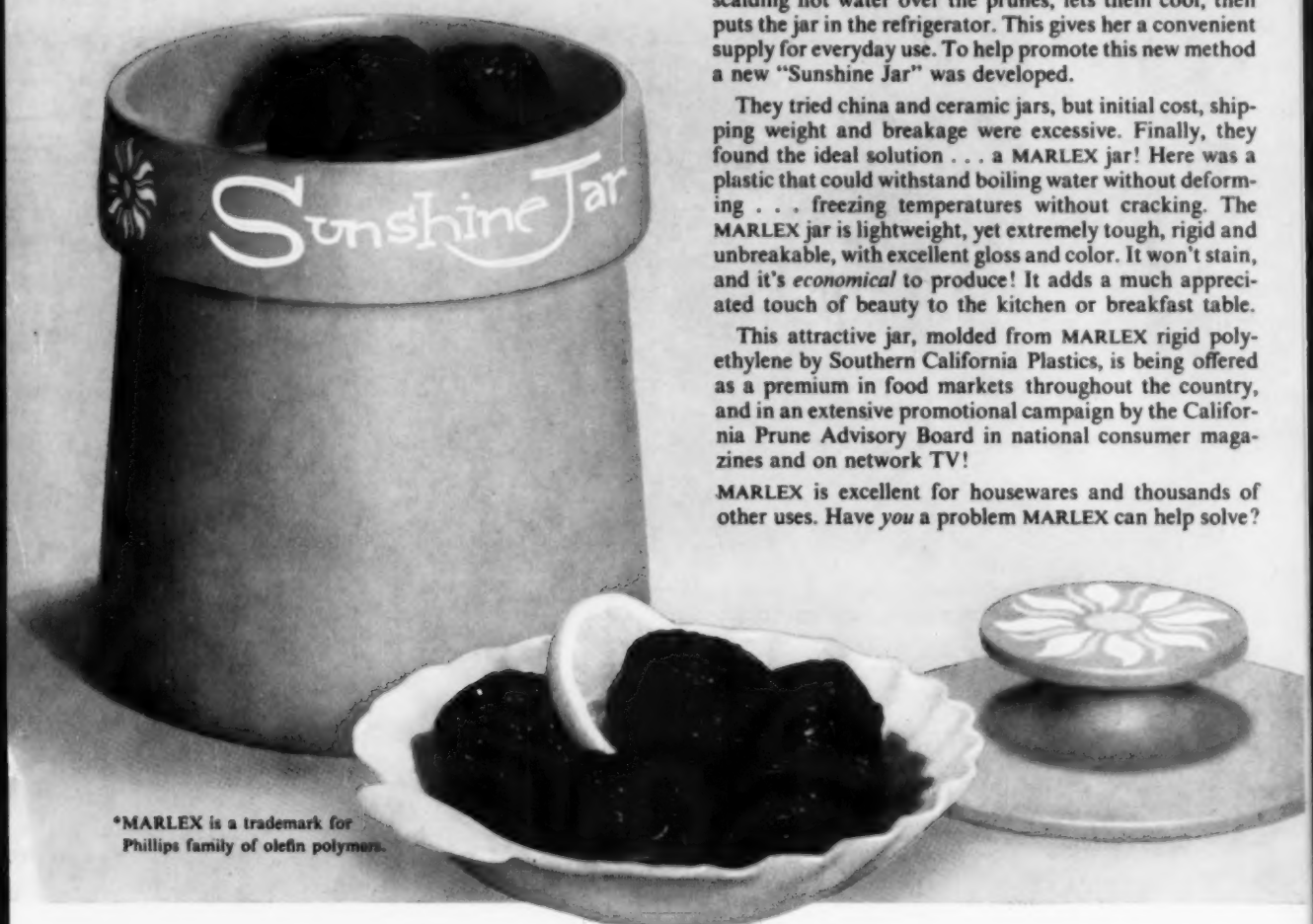
sparks nationwide premium promotion!

The California Prune Advisory Board recently came up with a brand new prune preparation idea . . . the "Sunshine Jar method". To plump prunes, the housewife pours scalding hot water over the prunes, lets them cool, then puts the jar in the refrigerator. This gives her a convenient supply for everyday use. To help promote this new method a new "Sunshine Jar" was developed.

They tried china and ceramic jars, but initial cost, shipping weight and breakage were excessive. Finally, they found the ideal solution . . . a MARLEX jar! Here was a plastic that could withstand boiling water without deforming . . . freezing temperatures without cracking. The MARLEX jar is lightweight, yet extremely tough, rigid and unbreakable, with excellent gloss and color. It won't stain, and it's *economical* to produce! It adds a much appreciated touch of beauty to the kitchen or breakfast table.

This attractive jar, molded from MARLEX rigid polyethylene by Southern California Plastics, is being offered as a premium in food markets throughout the country, and in an extensive promotional campaign by the California Prune Advisory Board in national consumer magazines and on network TV!

MARLEX is excellent for housewares and thousands of other uses. Have *you* a problem MARLEX can help solve?



*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma

A subsidiary of Phillips Petroleum Company

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